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# NHS Health Check programme: A rapid review update.

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## Abstract

**Objective:** To update a rapid review published in 2017, which evaluated the NHS Health Check Programme.

**Methods:** An enlarged body of evidence was used to re-address six research objectives from a rapid review published in 2017, relating to the uptake, patient experiences and effectiveness of the NHS Health Check Programme. Data sources included: Medline; PubMed; Embase; Health Management Information Consortium (HMIC); Cumulative Index of Nursing and Allied Health Literature (CINAHL); Global Health; PsycInfo; the Cochrane Library; NHS Evidence; Google Scholar; Google; Clinical Trials.gov and the ISRCTN registry; Web of Science; Science Citation Index; The Cochrane Library; NHS Evidence; Open Grey and hand searching article reference lists. Screening, data extraction and quality appraisal using the Critical Appraisals Skills Programme checklists were performed in duplicate. Grading of Recommendations, Assessment, Development and Evaluations was implemented. Data were synthesised narratively.

**Results:** A total of 697 studies were identified, 29 were newly included in this review update. The number of published studies on uptake, patient experiences and effectiveness of the NHS Health Check Programme increased 43% since the rapid review published in 2017. However, findings from the original review remain largely unchanged, which may reflect the larger number of studies included previously (n=68). Individuals most likely to attend the NHS Health Check Programme are females, persons of white British ethnicity, and individuals aged ≥60 years. Smokers and the most socioeconomically deprived are least likely to attend. Opportunistic and personalised invitations increased uptake compared to the standard invitational letters. Variations exist in the management of individuals with high cardiovascular disease (CVD) risk.

**Conclusions:** Although results are inconsistent between studies, the NHS Health Check programme is associated with increased detection of heightened CVD risk factors, increased CVD diagnoses, a reduction in smoking prevalence and CVD risk factors and increased prescribing of statins.

## Article summary

- This review summarises newly identified evidence evaluating the NHS Health Check (NHS-HC) Programme, building on an earlier rapid review published in 2017.
- The methods involved searches of published and grey literature sources, duplicate blinded screening, data extraction and quality appraisal and assessment of the quality of the overall body of evidence for each objective.
- Meta-analysis was not feasible due to the heterogeneous nature of the included studies.
- The results indicate that the NHS-HC programme increases the detection of individuals at risk of cardiovascular disease and that inequalities exist in NHS-HC attendance between population sub-groups.
- The overall body of evidence addressing the review objectives were ‘very low’ to ‘moderate’ quality therefore caution should be used when interpreting findings.

## Introduction

Introduced in 2009, the NHS Health Check (NHS-HC) Programme is a cardiovascular disease (CVD) prevention programme aiming to assess all adults in England aged between 40 and 70 years old for CVD risk factors including: obesity; physical inactivity; smoking; high alcohol consumption; high blood pressure and high cholesterol. Following an assessment, using established tools, the level of individual risk is communicated to patients and evidence-based risk reduction interventions are implemented where appropriate.(1, 2) A rapid synthesis of published research evidence on the NHS-HC Programme was completed by Usher-Smith et al. (2017), incorporating evidence from studies published up to 9th November 2016.(1) Our aim was to update this rapid review and summarise newly identified evidence addressing the following research objectives:

1. Who is and who is not having an NHS Health Check (NHS-HC)?
2. What are the factors that increase take-up among the population and sub-groups?
3. Why do people not take up an offer of an NHS-HC?
4. How is primary care managing people identified as being at risk of cardiovascular disease or with abnormal risk factor results?
5. What are patients' experiences of having an NHS-HC?
6. What is the effect of the NHS-HC on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and on statin and anti-hypertensive prescribing?

## Methods

A rapid review update reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Supplementary file S1).(3)

### Patient and public involvement

No patient involved.

### Literature searches

The following databases were searched, from January 1996 to November 2016 in the earlier review(1) and from Jan 2016 to Dec 2019 for this update: Medline; PubMed; Embase; Health Management Information Consortium (HMIC); Cumulative Index of Nursing and Allied Health Literature (CINAHL); Global Health; PsycInfo; the Cochrane Library; NHS Evidence; Google Scholar; Google; Clinical Trials.gov and the ISRCTN registry; Web of Science; Science Citation Index and OpenGrey. Hand searching of key article reference lists was also completed. The search strategy is available in supplementary file S2.

## Study selection and data extraction

Studies from the earlier review(1) were also included in the review update synthesis. Two authors (out of FP, RPWK and LMT) independently reviewed titles, abstracts and full texts of studies from updated searches using pre-specified inclusion and exclusion criteria (supplementary file S3) to identify studies eligible for inclusion. Conflicts were resolved through discussion, with adjudication by a third reviewer (FP) where necessary. A random 10% sample of the original review(1) data extraction was validated. Data from newly identified studies were extracted onto pre-specified, piloted, data pro-forma. One reviewer (RPWK or LT) data extracted quantitative studies. Extracted data were then checked for accuracy by a second reviewer (RPWK or LT). Two reviewers (MS and FP) independently data extracted qualitative studies with discrepancies discussed and resolved.

## Quality appraisal

The quality of newly identified studies was assessed by a single reviewer then verified by a second. Qualitative studies were assessed by MS or FP using The Critical Appraisal Skills Programme (CASP) checklist for qualitative research.(4) To accommodate the range of study designs included quantitative studies were assessed by RPWK or LT using amended CASP tools(4) implemented by the previous review team(1).

## Data synthesis

Synthesis of new quantitative and qualitative data was completed as an extension to that undertaken in the original review. Numerical data were combined using a structured, narrative synthesis. Meta-analysis was not methodologically appropriate due to high heterogeneity and a low number of high-quality studies reporting on each objective in a consistent manner. For the qualitative data, a three-stage thematic synthesis approach developed by Thomas and Harden (2008)(5) was planned in which newly identified studies could add to and potentially revise the original findings.

## Assessment of the certainty of the evidence

GRADE,(6) GRADE-CERQual(7) and a method for assessing certainty of evidence in mixed methods reviews(8) were used to assess the certainty and confidence in quantitative, qualitative and mixed methods evidence, respectively, contributing to each objective and sub-objective as appropriate.

## Results

The flow of included and excluded studies is shown in Figure 1. Twenty-nine newly identified studies were eligible for inclusion. The numbers of newly identified studies mapping to each research objective are as follows: objective 1 (n=6), objective 2 (n=9), objective 3 (n=0), objective 4 (n=4), objective 5 (n=2) and objective 6 (n=13). Quality appraisal scores for each study are shown in supplementary file S4. GRADE assessments are shown in supplementary file S5. The overall certainty of evidence ranged from 'very low' to 'moderate'. Results are also synthesised below in relation to each objective and sub-objective.

Figure 1: Flow of included and excluded studies.

***Objective 1: Differences in demographics of those attending and not attending an NHS Health Check***

NHS digital and Public Health England (PHE) published attendance data from 2012 to 2018.(9) The national average attendance was 44.2%, with variation across regions (range = 41.3-49.2%). The variation was greater at a local authority level where 2017-18 attendance varied from 19.5% to 75.8%. The original review identified 24 studies relevant to this objective. This update identified 6 new studies.

Generally, those attending were more likely to be older adults (e.g. > 60 years old)(10-12) although using opportunistic invitations lead to an increase in younger patients attending.(13) Evidence suggested males are less likely to attend than females,(9-11, 13, 14) as statistically evidenced in Lang et al. (2016) (AOR: 0.75, 95% CI: 0.67-0.84)(14) and Coghill et al. (2018) (AOR: 0.73, 95% CI: 0.67-0.8).(11) Chattopadhyay and colleagues (2019),(12) however, provide some evidence that males may be more likely to attend than females when the NHS-HCs were conducted opportunistically.

Attendance data regarding ethnic groups is inconclusive. The NHS Digital data(9) shows that each ethnic group was more likely to attend than not attend between 2012 and 2018. For example, white British attendance ranged from 77.8 to 81.5%, while non-attendance ranged from 62.3 to 67.9%. Additionally, attendance by individuals with Asian or British Asian background ranged from 6.5 to 8.9%, with non-attendees ranging from 4 to 5.4%. (9, 10) Chang and colleagues (2016)(10), however, claim that white British are more likely to attend at a national level but given that white British make up most of the eligible population this finding could be misleading. Attendance by ethnicity probably varies depending upon location. For example, community data from Leicester showed white people were less likely to attend.(12) In terms of socio-economic status, there is some evidence those from a higher level of deprivation (identified by IMD) are less likely to attend an NHS-HC.(11, 12) However, opportunistic NHS-HCs show an increase in attendance from those of a higher deprivation level.(13)

There is evidence to suggest those who smoke are less likely to attend an NHS- HC.(12, 14) Chattopadhyay and colleagues (2019)(12) also reported the effect of religion on attendance, suggesting non-Christians were more likely to attend than Christians. Those with no religious background were less likely to attend overall. However, this finding was from a single small community-based study and it is, therefore, difficult to make any inferences about the wider population.

The GRADE certainty in evidence rating for Objective 1 was 'low' due to the observational nature of study designs that contributed evidence.

***Objective 2: What factors increase take-up among population and sub-groups?***

Uptake has maintained a range of 45-50%, with recent national data from PHE reporting an uptake of 45.9% for 2018/2019.(15) There are, however, variations by region and constituency. For example, in the North East uptake varied between 25% and 61%.

*Objective 2.1 Socio-demographic factors of uptake*

There were 11 quantitative studies included in the original review. We identify one new quantitative study conducted in two London boroughs (18 GP practices) reporting socio-demographic differences in uptake.(16) A randomised control trial (RCT) assessing uptake via standard invitation letter or a question behaviour effect (QBE) questionnaire (with/without financial incentive) followed by the invitation letter. Uptake across the three trial arms was 15.3%. This is significantly lower than previously reported (Attwood et al., 2015:(17) 27%; Coghill et al., 2016:(18) 34.1%; Dalton et al., 2011: 44.8%(19)). McDermott and colleagues (2018)(16) also found males and younger people less likely to attend an NHS-HC. Those with a non-white ethnic background were more likely to attend, however, this study area includes a large proportion of individuals from a non-white ethnic background and results may not be reflective of the wider population. Contradictory to Objective 1 findings, those from the second least deprived quintile were more likely to attend than those from the most deprived.

*Objective 2.2 Invitational methods*

Six new studies, adding to seven previously identified, assess the effects of different invitational methods, compared to the standard invitational letter, on uptake.(16, 20-24) Use of the QBE questionnaire alone or with a financial incentive (£5) did increase uptake when it was returned. There were, however, no statistically significant changes in risk difference between the two invitation types (1.52%, 95% CI: -0.03 to 3.07%, $p = 0.054$). This is lower than previous research estimating a 3-4% change.(25) Gidlow and colleagues (2019) compared the use of modified letters and telephone invitations.(22) While Sallis et al. (2019) compared a letter with yes/no SMS pre and post invitation.(24) One study implemented new shorter leaflet styles (two vs four pages) but there were no statistically meaningful changes in uptake.(23) Use of SMS reminders and time limited letters did, increased uptake;(23) confirming the positive results previously reported in a similar study (Alpsten et al., 2015(26)). Telephone invitations also improved uptake compared to the standard letter invitation and a personalised CVD risk.(22) A cost analysis suggests that for every 1000 patients invited by telephone (compared to standard letters) an additional 180 NHS-HC could be expected, with an extra cost of £0.24/patient. Telephone invitations are also strongly preferred by primary care and outreach workers.(27) Finally, the use of opportunistic invites compared with the standard invitational letter improved uptake of those identified at greater CVD risk (i.e. risk score 10%).(21)

*Objective 2.3 Setting*

This update identified two quantitative studies which assessed the impact of setting on uptake rates; none were identified in the earlier review. These studies compared a GP setting to an outreach service(28) or community pharmacy.(29) Roberts and colleagues targeted hard-to-reach groups using opportunistic methods. While GP attendance was three times more than the outreach services, people of a South Asian ethnicity and higher IMD were more likely to attend the outreach services.(28) Males, however, were more likely to attend a GP than an outreach or community pharmacy service.(28, 29) Whittaker (2019) found minimal differences in uptake of NHS-HCs after invitation by letter.(29) Opportunistic methods may provide greater uptake in some harder-to-reach patients.

The GRADE certainty in evidence ratings for Objectives 2.1-3 ranged from 'low' due to the observational nature of study designs to 'very low' due to high risk of bias ratings.

***Objective 3: Why do people not take up an offer of an NHS Health Check?***

No new studies addressed this objective.

***Objective 4: How primary care is managing people identified as being at risk of CVD or with abnormal risk factor results***

Alageel et al. (2019) is the only study across both reviews to focus on risk management. They assessed CVD risk factors in England over a six-year follow-up period. An interrupted time series analysis (ITS) revealed mean Body Mass Index (BMI) following a health check was 0.3kg/m$^2$ (95% CI: 2-0.39kg/m$^2$) lower, while control patients' (no health check) BMI increased (0.08kg/m$^2$, 95% CI: 0.07-0.09kg/m$^2$ per year).(30) Additionally, after the six-year period, patients who had a health check were less likely to be smokers (AOR: 0.9, 95% CI: 0.87-0.94). NHS-HC attendees also had lower systolic and diastolic blood pressure, and lower total cholesterol.(30) High density lipoprotein was, however, slightly higher after six-years (0.01, 95% CI: 0.002-0.02). This single large study provides evidence that NHS-HCs can increase provision of risk management advice and interventions.

Fifteen qualitative studies were identified by the previous review, a further three are presented here. Three qualitative studies(27, 31, 32) investigated the views of those responsible for delivery of NHS-HCs. Healthcare professionals interviewed by Alageel et al. (2018)(31) suggested that an NHS-HC was unlikely to be successful because people already knew the positive health behaviours they needed to engage with, but chose to ignore public health messaging. In a later study, Alageel and colleagues (2020)(32) found that GPs seemed more negative towards delivery of NHS-HCs than other staff. NHS-HCs were seen as time consuming or unclear in terms of outcome. Several GPs felt that it would be more efficient if health care assistants (HCAs) conducted the NHS-HCs as the HCAs role is more focused on health promotion activities so they are more likely to have the opportunity and skills to elicit more personal information from patients. In contrast, HCAs were unsure if they had the right skills to undertake NHS-HCs, and indeed, whether this should be part of their role. Stone (2019) found health professionals thought it was beneficial to have someone from a similar ethnic background invite a patient for an NHS-HC, as they understood how certain elements of the NHS-HC would relate to specific communities. They also identified that employing outreach workers freed up GP and practice staff time to focus on other tasks. However as outreach staff worked across multiple practices in the district, some practice managers were negative about the system as it meant they did not operationally manage them.

The certainty in evidence rating for Objective 4 was 'moderate'.

***Objective 5: Patient views on NHS Health Check***

Hawking (2019) found patients felt a sense of obligation to attend and be “a willing patient”, but family history affected how likely they were to make a change.(33) Some pointed to longevity in their family as a reason to avoid changing their health behaviours, others felt that as family members had high risk of CVD disease, it was inevitable they too would experience high risk, regardless of any behaviour change. In both Alageel et al.’s studies(31, 32) patients could not recall a specific risk score but did remember discussions around their current state of health. People felt more able to make change when their family and friends supported and facilitated them to do so. Individuals valued being able to use their results from their NHS-HC to converse with their support networks identifying and introducing changes to their behaviours. Whilst one patient found the form filling and nature of the questioning to be off-putting,(33) the majority felt the experience of having a health check was positive.

The certainty in evidence rating for Objectives 5 was ‘low’ due to the subjective nature of participant data, to ‘moderate’.

***Objective 6: Effects of the NHS Health Check Programme on health outcomes***

Studies mapped to Objective 6 assessed the effects of the NHS-HCs on one of the following predefined health outcomes: disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and statin and antihypertensive prescribing.

*Objective 6.1 Disease detection*

Seventeen studies reported data on disease detection, five of these were newly identified. One of the newly identified studies used data from 455 GP practices across England.(34) Incidence rates of detected non-diabetic hyperglycaemia and type 2 diabetes were significantly higher amongst individuals registered at GP surgeries with high NHS-HC coverage, compared to low coverage surgeries. Rates of non-diabetic hyperglycaemia were reported to be 19% higher in the high coverage compared to the low coverage group (Hazard Ratio (HR) 1·19, 95% confidence interval (CI) 1·01 to 1·41) and rates of type 2 diabetes were 10% higher (HR 1·11, 95% CI 1·03 to 1·19).(34)

Four studies used samples from smaller areas of England. Gulliford et al. (2017) reported that individuals who received opportunistic NHS-HCs offered during patient encounters for other reasons, were significantly more likely to have a higher 10-year risk of CVD (CVD risk score ≥ 10%, assessed using the Joint British Societies’ ‘JBS3’ risk calculator) compared to individuals who chose to attend following an invitation.(21) Robson et al. (2017)(35) and Kennedy et al. (2019)(36) reported that NHS-HC attendance compared to non-attendance was associated with significant increase in detection or diagnosis of the following conditions: CVD risk > 10%;(36) diabetes and hypertension,(35, 36) total cholesterol(36) and chronic kidney disease.(35) Lang et al. (2016) compared disease detection rates between NHS Health Check attendees from different socioeconomic groups and reported a significant increase in the detection of CVD risk > 20% amongst individuals from the most deprived IMD decile.(14)

*Objective 6.2 Health-related behaviours*

Five studies (one newly identified) reported data on health-related behaviours. The newly identified study used national (England) data from the Clinical Practice Research Datalink dataset. NHS-HC participants were less likely to be smokers compared to a control group after six years' follow-up (health check 17% versus controls 25%; odds ratio (OR) 0.90, CI 0.87 to 0.94, p < 0.001) however, a greater reduction in smoking prevalence was reported for the control group.(30)

*Objective 6.3 Risk management referrals*

Ten studies (four newly identified) reported data quantifying the proportion of NHS-HC attendees who were referred to lifestyle services. Two of the new studies used data from across England,(32, 37) one study involved a sample of 151 general practices in Hampshire (36)and the other from 38 GP practices in Bristol.(11)

The proportions of NHS-HC attendees who were offered risk management advice or referrals varied between studies and in relation to the risk factor addressed, from 1.8-90% for smoking cessation interventions, < 1 % to 73% for weight management interventions among patients with a BMI of ≥ 30, and between 0.01%, and 33.9% for interventions to reduce alcohol consumption amongst patients who consumed ≥ 14 units per week.

*Objective 6.4 CVD risk*

Five studies (one newly identified) assessed the change in CVD risk factor values following the NHS-HC. The newly identified study used national data from across England. Adjusted mean differences in 10-year CVD risk scores between intervention recipients and non-recipients at six years post-NHS-HC, were as follows: body mass index (Kg/m$^2$) -0.30 (95% CI -0.39 to -0.20, p<0.001); systolic blood pressure (mean, mm Hg) -1.43 (95% CI -1.70 to –

1.16, p<0.001); diastolic blood pressure (mean, mm Hg) -0.93 (95% CI -1.11 to -0.75, p<0.001) total cholesterol (mean, mmol/L) – 0.05 (95% CI -0.07 to – 0.03, p<0.001), high density lipoprotein cholesterol (mean, mmol/L) 0.01 (95% CI 0.002 to 0.02, p>0.05).(30)

*Objective 6.5 Prescribing of statins and anti-hypertensives*

Sixteen studies (four newly identified) reported data on prescribing after the implementation of NHS-HC. One of the newly identified studies which used national data from across England reported that NHS-HC participants were more likely to receive statins (HR 1.24, 1.21 to 1.27, p < 0.001) and were less likely to receive antihypertensive drugs (HR 0.86, 95% CI 0.85 to 0.88, p < 0.001) compared to non-attendees.(30) Robson et al. (2017) found that new statin prescriptions were higher for NHS-HC attendees compared to non-attendees.(35) The proportions of new statin prescriptions administered to NHS-HC attendees versus non-attendees were 11.5% and 8.2%, respectively. These data were from 143 general practices in three clinical commissioning groups (CCGs) in east London (England, UK). Kennedy et al. (2019) also reported that NHS-HCs led to increased use of statins (OR 1.54, 95% CI 1.39 to 1.71) in addition to anti-hypertensives (OR 1.15, 95% CI 1.06 to 1.24) using data from 151 GP practices in Hampshire.(36) Coghill et al. (2018) compared prescribing rates between population sub-groups (male/female and age group) among NHS-HC attendees using data from GP practices in Bristol.(11) The results indicated that women were more likely than men to be prescribed a cardiovascular drug, (OR 1.18, 95% CI 1.03 to 1.35) as were patients aged ≥ 70 years compared to aged ≤70 years (OR 1.64, 95% CI 1.14 to 2.35). In the same study, individuals classified as being at high risk of CVD were most likely to be prescribed CVD medication (OR 6.16, 95% CI 4.51 to 8.40). There was no evidence of any association between the prescribing of CVD medication and socioeconomic status or ethnicity.

*Objective 6.6 Economic modelling studies*

Six studies (three newly identified) assessed the cost-effectiveness of the NHS-HC Programme based on different implementation approaches. Two of the new studies, which are related, assessed implementation and re-design scenarios using demographic data from Liverpool's population, exposure to risk factors and CVD epidemiology to assess health benefits, equity and cost effectiveness.(38, 39) The third, Hinde et al (2017), assessed whether the impact of the checks on BMI was sufficient to justify its costs.(40) Collins et al. (2017; 2019)(38, 39) reported that the equitability and cost-effectiveness of the NHS-HC Programme would be increased through the addition of policies targeting dietary consumption and through combining current provision with targeting of the intervention in deprived areas (Collins et al. 2020).(38) Hinde et al. (2017) reported that even modest changes in BMI from the NHS-HC Programme are associated with significant cost-saving benefits making the programme cost-effective.(40)

The GRADE certainty in evidence ratings for Objectives 6.1-5 ranged from 'very low' due to risk of bias, indirectness, imprecision and inconsistency, to 'moderate'.

## Discussion

The goal of the NHS-HC Programme is to identify and reduce CVD risk in those aged between 40 and 74 years. This rapid review aimed to update existing evidence on a previously completed review.(1)

*Principal findings*

The proportion of published studies has increased by 43% since the earlier review by Usher-Smith et al. (2017).(1) However, the majority of the key findings from the original review remain unchanged in this review update. The overall results from the earlier review and the review update are summarised as follows for each objective:

Objective 1 *Who is and who is not having an NHS Health Check?* Individuals most likely to attend an NHS Health Check are female, white British and aged 60 or more. Smokers and those from high levels of deprivation are least likely to attend.

Objective 2 *What are the factors that increase take-up among the population and sub-groups?* Opportunistic and personalised invitations (particularly telephone invites and text message reminders) increased uptake compared to the standard invitational letters.

Objective 3 *Why do people not take up an offer of an NHS Health Check?* No new studies were available that addressed this objective in the review update reported here. The earlier review by Usher-Smith et al. (2017)(1) reported that lack of awareness or knowledge, competing priorities, misunderstanding the purpose, an aversion to preventive medicine, difficulty getting an appointment with a GP, and concerns about privacy and confidentiality were found to reduce NHS Health Check attendance.

Objective 4 *How is primary care managing people identified as being at risk of cardiovascular disease or with abnormal risk factor results?* We found variations in risk management referrals across the reviewed studies.

Objective 5 *Patient views on the NHS-HC Programme:* Overall patient satisfaction levels with the programme were high, however the risk score was less helpful to patients than discussion about their health with the clinician during the NHS-HC. Behaviour change may be influenced by perceived risk based on family history and social support.

Objective 6 *What is the effect of the NHS Health Check on disease detection…?*

Overall, the NHS Health Check programme is associated with increased detection of CVD risk factors and diagnoses, increased prescribing of cardiovascular medications and with a general reduction in CVD risk factors. The economic evidence indicated that the cost-effectiveness of the NHS Health Check programme varies; population-wide interventions were more cost-effective than individual level interventions and interventions targeted at deprived areas were more cost-effective compared to non-targeted interventions.

*Strengths and weaknesses of the study*

The methods utilised to review the evidence available on the NHS-HC Programme involved searches of published and grey literature sources, duplicate blinded screening, data extraction and quality appraisal and assessment of the quality of the overall body of evidence for each objective. Methods used to synthesise the new data with the existing body of evidence were appropriate given the quantity and types of new studies identified. Review limitations included that it was not possible to perform meta-analysis due to the heterogeneous nature of the included studies. The use of 'vote counting' methods potentially compromises the precision of the results.(41)

*Strengths and weaknesses of the available evidence*

General consistency of findings across studies in relation to each review objective supports causal inferences regarding the direction of effect of the NHS-HC Programme on the health-related outcomes assessed. The overall quality of evidence varied between objectives and ranged from 'very low' to 'moderate', reflecting issues including that most studies were observational with confounding and poor internal validity (assessed using risk of bias). Furthermore, inconsistent data collection and reporting across many of the studies reduces precision of estimated effect of the NHS-HC Programme on health-related outcomes.

*Implications for policy and practice*

The results from this review could inform changes to the methods used to invite eligible individuals to attend an NHS-HC, for example by modifying the invitation method (e.g. telephone invitations and sending text message reminders). Opportunistic recruitment could be used to selectively target specific groups who are at greater risk, as well as those who are less likely to engage with the NHS-HC Programme.

*Unanswered questions and future research*

There is a need to understand more fully the effect of the programme on lifestyle behaviours including further research to explore the impact of attending an NHS-HC on physical activity, diet, and alcohol consumption. The identified barriers to the uptake of an NHS-HC need to be explored in more depth as they could inform improvement of recruitment to the programme. A review of interventions for CVD (e.g. physical activity or diet change), outside of the NHS-HC Programme could help inform further development of the programme.

*Conclusions*:

The NHS-HC programme increases the detection of individuals at risk of cardiovascular disease. The overall body of evidence addressing the review objectives were 'very low' to 'moderate' quality therefore caution should be used when interpreting findings, which appear to show that inequalities exist in NHS-HC attendance between population sub-groups. There are also geographical variations rates of referral to lifestyle services following NHS-HCs. Targeting NHS-HCs towards high-risk communities (e.g. deprived communities) may increase the cost-effectiveness of the programme. Uptake may be increased through opportunistic and personalised invitations in addition to addressing misconceptions regarding the purpose, importance and confidential nature of the programme.  Discussion between NHS-HC attendees regarding their health and their GP may be more helpful than receiving a risk score, which may not be understood or remembered by the patient. Family history of disease and social support could determine the impact of the intervention of behaviour change.

**Authors contributors:** FP, KT and RBG conceptualised and designed the review. Literature searches were designed and implemented by Public Health England's Information Specialist Team and FP. FP, LT, RBG and RPWK reviewed titles, abstracts and full-text papers for eligibility. FP, LT, MS, RBG and RPWK completed data extraction and quality appraisal. The manuscript were prepared by FP, LT, MS and RPWK. JL, KT and RBG provided critical review of the manuscript.

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**Patient consent:** Not required.

**Data sharing statement:** No original data were generated for this study.

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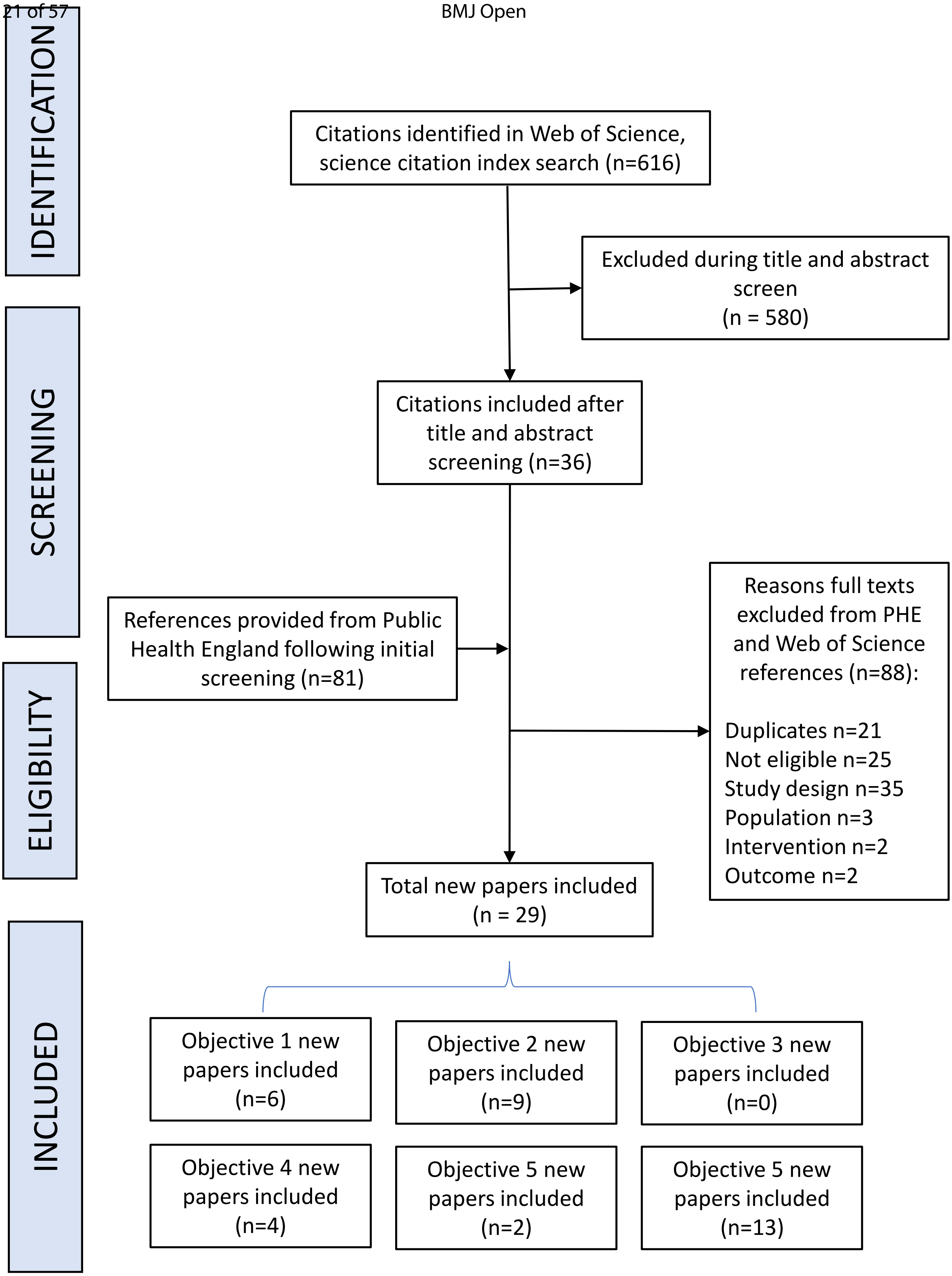
IDENTIFICATION
SCREENING
ELIGIBILITY
INCLUDED
Citations identified in Web of Science, science citation index search (n=616)
Excluded during title and abstract screen
(n = 580)
Citations included after title and abstract screening (n=36)
References provided from Public Health England following initial screening (n=81)
Reasons full texts excluded from PHE and Web of Science references (n=88):
Duplicates n=21
Not eligible n=25
Study design n=35
Population n=3
Intervention n=2
Outcome n=2
Total new papers included
(n = 29)
Objective 1 new papers included (n=6)
Objective 2 new papers included (n=9)
Objective 3 new papers included (n=0)
Objective 4 new papers included (n=4)
Objective 5 new papers included (n=2)
Objective 5 new papers included (n=13)

# PRISMA 2009 Checklist

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a systematic review, meta-analysis, or both. | 1 |
| **ABSTRACT** | | | |
| Structured summary | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | 2 |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. | 4 |
| Objectives | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | 4 |
| **METHODS** | | | |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | N/A |
| Eligibility criteria | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | Supplementary file S3 |
| Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | 2, 4 & Supplementary file S2 |
| Search | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | Supplementary file S2 |
| Study selection | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | 5 & Supplementary file S3 |
| Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | 5 |
| Data items | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | Supplementary file S6a & S6b |
| Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | 5 & Supplementary file S4 |

# PRISMA 2009 Checklist

| | | | |
|---|---|---|---|
| Summary measures | 13 | State the principal summary measures (e.g., risk ratio, difference in means). | NA |
| Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$) for each meta-analysis. | 5 |



| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). | 5 & Supplementary file S5 |
| Additional analyses | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. | N/A |
| **RESULTS** | | | |
| Study selection | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. | 6 & Figure 1 |
| Study characteristics | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | 6 to 14 & Supplementary file S6a & S6b |
| Risk of bias within studies | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12). | Supplementary file S4 & S5 |
| Results of individual studies | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. | 6-13 |
| Synthesis of results | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency. | N/A |
| Risk of bias across studies | 22 | Present results of any assessment of risk of bias across studies (see Item 15). | Supplementary file S5 |
| Additional analysis | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). | N/A |
| **DISCUSSION** | | | |
| Summary of evidence | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | 2 and 13 |
| Limitations | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). | 14 |
| Conclusions | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | 15 |

# PRISMA 2009 Checklist

| | | | |
|---|---|---|---|
| **FUNDING** | | | |
| Funding | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. | 16 |

*From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

| Database | Search strategy |
|---|---|
| Ovid Medline | 1. health check*.tw.<br>2. (diabetes adj3 screen*).tw.<br>3. (cardiovascular adj3 screen*).tw.<br>4. (population adj2 screen*).tw.<br>5. (risk factor adj3 screen*).tw.<br>6. (opportunistic adj3 screen*).tw.<br>7. medical check*.tw.<br>8. general check*.tw.<br>9. periodic health exam*.tw.<br>10. annual exam*.tw.<br>11. annual review*.tw.<br>12. NHSHC.tw.<br>13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12<br>14. cardiovascular adj3 prevention.tw.<br>15. (primary care or general practice or primary healthcare).tw<br>16. 14 and 15<br>17. Cardiovascular Diseases/ AND Primary Prevention/<br>18. 16 or 17<br>19. 13 or 18 |
| PubMed | 1. health check*<br>2. diabetes screen*<br>3. cardiovascular screen*<br>4. population screen*<br>5. risk factor screen*<br>6. opportunistic screen*<br>7. medical check*<br>8. general check*<br>9. periodic health exam*<br>10. annual exam*<br>11. annual review*<br>12. NHSHC<br>13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12<br>14. Cardiovascular Diseases AND Primary Prevention[MeSH Terms]<br>15. "primary care"[Text Word] OR "general practice"[Text Word] OR "primary healthcare"[Text Word])<br>16. (cardiovascular[Text Word] AND prevention[Text Word])<br>17. #15 and #16<br>18. #14 or #17<br>19. #13 or #18 |
| Ovid Embase | 1. health check*.tw.<br>2. (diabetes adj3 screen*).tw.<br>3. (cardiovascular adj3 screen*).tw.<br>4. (population adj2 screen*).tw. |

| | |
|---|---|
| | 5. (risk factor adj3 screen*).tw.<br>6. (opportunistic adj3 screen*).tw.<br>7. medical check*.tw.<br>8. general check*.tw.<br>9. periodic health exam*.tw.<br>10. annual exam*.tw.<br>11. annual review*.tw.<br>12. NHSHC.tw.<br>13. periodic medical examination/<br>14. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13<br>15. cardiovascular adj3 prevention.tw.<br>16. (primary care or general practice or primary healthcare).tw<br>17. 15 and 16<br>18. cardiovascular disease/ AND primary prevention/<br>19. 17 or 18<br>20. 14 or 19 |
| Ovid HMIC | 1 "health check*".af.<br>2 health checks/<br>3 (cardiovascular or vascular or heart or diabetes or stroke).af.<br>4 (screen* or risk).af.<br>5 3 AND 4<br>6 1 OR 2 or 5<br>7 cardiovascular adj3 prevention.tw.<br>8 (primary care or general practice or primary healthcare).tw<br>9 7 and 8<br>10 Cardiovascular diseases/ AND exp preventive medicine/<br>11 9 or 10<br>12 6 or 11 |
| EBSCO CINAHL | S10 S1 OR S2 OR S9<br>S9 S5 OR S8<br>S8 S6 AND S7<br>S7 (MH "Preventive Health Care+")<br>S6 (MH "Cardiovascular Diseases+")<br>S5 S3 AND S4<br>S4 "primary care" or "general practice" or "primary healthcare"<br>S3 TX cardiovascular N3 prevention<br>S2 (diabetes N3 screen*) OR (cardiovascular N3 screen*) OR<br>(population N2 screen*) OR (risk factor N3 screen*) OR (opportunistic<br>N3 screen*) OR “medical check*” OR “general check*” OR “periodic<br>health exam*” OR “annual exam*” OR "annual review*" OR NHSHC |

| | |
|---|---|
| | S1 health check* |
| EBSCO Global Health | S10 S6 OR S19 OR S3 Limiters - Publication Year: 2016<br>S9 S7 AND S8<br>S8 DE "preventive medicine"<br>S7 DE "cardiovascular diseases"<br>S6 S4 AND<br>S5 S5 "primary care" or "general practice" or "primary healthcare"<br>S4 TX cardiovascular N3 prevention<br>S3 S1 OR S2 131<br>S2 (diabetes N3 screen*) OR (cardiovascular N3 screen*) OR (population N2 screen*) OR (risk factor N3 screen*) OR (opportunistic N3 screen*) OR “medical check*” OR “general check*” OR “periodic health exam*” OR “annual exam*” OR "annual review*" OR NHSHC<br>S1 health check* |
| HDAS PsycInfo | 1 "health check*".af.<br>2 PHYSICAL EXAMINATION/<br>3 HEALTH SCREENING/<br>4 "diabetes screen*".af<br>5 "cardiovascular screen*".af<br>6 "population screen*".af<br>7 ("opportunistic* screen*" OR "risk factor screen*").af<br>8 ("medical check*" OR "general check*" OR "periodic health exam*" OR "annual exam*" OR "annual review*" OR NHSHC).af<br>9 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8<br>10 cardiovascular.ti,ab<br>11 prevention.ti,ab<br>12 10 AND 11<br>13 CARDIOVASCULAR DISORDERS/<br>14 PREVENTIVE MEDICINE/<br>15 13 AND 14 16 12 OR 15 17 9 OR 16 |
| Web of Science, Science Citation Index | “health check*” OR “diabetes screen*” OR “cardiovascular screen*” OR “population screen*” OR “risk factor screen*” OR “Opportunistic screen*” OR “medical check*” OR “general check*” OR “periodic health exam*” OR “annual exam*” OR “annual review*” OR NHSHC OR (Cardiovascular NEAR/3 prevention) AND (“primary care” OR “general practice” OR “primary healthcare”) Limit to: England, Scotland, Wales, North Ireland |
| Cochrane Library (Wiley) | #1 "health check*" #2 (diabetes next/3 screen*) or (cardiovascular next/3 screen*) or (population next/2 screen*) or (opportunistic next/2 screen*) or ("risk factor" next/3 |

| | |
|---|---|
| | screen*) or "medical check*" or "general check*" or "periodic health exam*" or "annual exam*" or "annual review*" or NHSHC #3 cardiovascular adj3 prevention.tw. #4 (primary care or general practice or primary healthcare).tw #5 #3 and #4 #6 MeSH descriptor: [Cardiovascular Diseases] this term only #7 MeSH descriptor: [Primary Prevention] explode all trees #8 #6 and #7 #9 #5 or #8 #10 #1 or #2 or #9 |
| NHS Evidence | “health check*” OR cardiovascular prevention primary care |
| TRIP database | “health check*” OR cardiovascular prevention primary care |
| Google Scholar | "nhs health check" cardiovascular “health check” cardiovascular prevention “primary care” |
| Google | "nhs health check" cardiovascular prevention “primary care” cardiovascular “health check” |
| Clinical trials.gov and ISRCDN registry | “health check” |

**PHE NHS health checks inclusion/exclusion criteria**

**Study Type Inclusion Criteria**

All studies must have included the NHS Health Check. Primary studies and guidelines will be included. Primary studies should have one of the following designs:

- RCT or cluster RCT
- Quasi RCT or cluster quasi RCT
- Controlled and uncontrolled pre- post-studies with appropriate comparator groups
- Interrupted time series
- Cohort studies (prospective and retrospective
- Case-control studies
- Qualitative studies from any discipline or theoretical tradition using recognised qualitative methods of data collection and analysis
- Economic and health outcome modelling

**Study Type Exclusion Criteria**

Editorials, commentaries and opinion pieces will be excluded

Table of inclusion and exclusion characteristics for each objective.

| Objective number | One | Two | Three | Four | Five | Six |
|---|---|---|---|---|---|---|
| **Question** | **Who is and who is not having an NHS health check** | **What factors increase take up among population and sub-groups** | **Why do people not take up an offer of an NHS health check** | **How is primary care managing people identified as being at risk of CVD or with abnormal risk factor results** | **What are patients' experiences of having an NHS health check** | **What is the effect of the NHS health check on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and on statin and antihypertensive prescribing** |
| **Research type** | Quantitative | Qualitative/Quantitative | Qualitative | Qualitative/Quantitative | Qualitative | Quantitative |
| **Included participants** | UK population eligible for NHS health checks (aged 40-74yrs) | UK population invited for NHS health checks | UK population eligible but not attending health checks | Primary care services across the UK providing health checks | UK population attending health checks | UK population eligible for NHS health checks |
| **Included measurements for extraction** | Demographics, patient condition characteristics (e.g. BMI, smoking status, CVD risk factors, etc) | Patient characteristics (subgroups, protected characteristics), setting characteristics (any health care), mode of delivery, booking system, cell/recall methods, take up rates, use of point of care testing, etc | Patient opinions, attitudes and experiences of health checks, choices made and why, reasons and beliefs underlying decisions. | Provider management protocols, recall methods, provider experiences of programme provision, referrals to lifestyle services, prescribing statins or anti-hypertensives, further investigations, adherence to guidelines etc | Patient opinions and experiences of health checks | Disease and condition detection rates, including hypertension, diabetes, chronic kidney disease, AF, familial hypercholesterolemia, peripheral vascular disease etc, behaviour change, referrals to local risk management services, reductions in individual risk factor prevalence or CVD risk, statin and anti-hypertensive prescribing, any other physical or mental health outcomes, cost effectiveness |
| **Exclusions** | Participants not eligible for health checks or receiving other forms of health check or screening services | Patients not eligible for health checks or taking up other forms of health check or screening services | Patients not eligible for health check or choosing not to take up other forms of health check or screening services | Primary care services not offering NHS health checks or people identified as at risk for CVD outside NHS health checks | Patients who have not had an NHS health check | Patients not eligible for an NHS health check |

| Objective | Author, date | Study addressed a clearly focused issue | Use of an appropriate method / Randomisation (for RCTs) | Recruitment / comparability of study groups at baseline | Blinding (for RCTs) | Exposure measurement | Outcome measurement | Comparability of study groups during study (for RCTs) | Follow up (for longitudinal studies) | Confounding factors (for non-RCTs) | Applicability to England | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Alageel and Wright, 2017 | High | Medium – cohort study | Medium – case and control groups were matched, but matching criteria weren't reported | NA | High | Medium – I assume that smoking prevalence was self-reported | NA | High | Medium/ can't tell | High | Medium |
| 6 | Chang et al. 2017 | High | Low - survey | Medium – lack of information re characteristics of comparison groups (e.g. the male sample could have been older and more prone to each health condition compared to the female group) | NA | High | Medium – lack of information re diagnosis of each condition of interest | NA | NA – this was a survey | Medium / can't tell – see 'recruitment/ comparability of study groups'<br><br>As gender and level of deprivation groups and were compared, these factors were controlled, however there was lack of control for multiple confounding | High | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | factors in each analysis | | |
| 2 | Coghill et al. 2016 | High | Medium – quasi experimental study | Medium – characteristics of comparison groups are presented, however there are no statistical comparisons to assess if the groups differ significantly on any characteristics | NA | High- standard approaches appear to have been used, with training provided to community workers who provided the telephone invites | High – attendance versus non-attendance and demographic characteristics, which I assume were accurately measured | NA | NA | Medium – age, gender, IMD but smoking and ethnicity were not controlled for | Low -data from Bristol | Low |
| 6 | Coghill et al. 2018 | High | Low- cross sectional | NA | NA | High- I would have thought it unlikely that demographic data were inaccurate | High - attendance or non-attendance at NHS Health Check | NA | NA – this was a survey | Medium – age, gender and IMD, but not ethnicity controlled for in adjusted models | Low – data from 38 GP practices, in Bristol. | Medium |
| 6 | Collins 2019 | Medium - not explicit | High | NA | NA | High | High | NA | NA | NA | Low – data from Liverpool | High |
| 6 | Collins 2017 | Medium - not explicit | High | NA | NA | High | High | NA | NA | NA | Low – data from Liverpool | High |
| 2 | Cornelius 2018 | Medium | High - RCT | Medium | Low – as unable to blind the format of the letter from participants | High – appears to have been standardised within groups | High (NHS health check uptake) | Medium (see 'Recruitment / comparability of study groups at baseline') | NA | NA | Low- data from 12 GP practices | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Gidlow 2019 | High | High – RCT | Medium - | Low – as unable to blind the format of the letter from participants | High | High | Medium (see 'Recruitment / comparability of study groups at baseline') | NA | NA | Low- practices from Stoke-on-Trent and Staffordshire | Low |
| 2 & 6 | Gulliford 2017 | High | Medium– cohort study | Medium | NA | High | High | NA | NA | High – ORs were adjusted for gender, age-group, ethnicity and IMD quintile | Low – study was conducted using data from two London boroughs | Medium |
| 6 | Hinde 2017 | High | High | NA | NA | High | High | NA | NA | NA | High | High |
| 1 | Chattopadhyay 2019 | High | Low- survey | NA | NA | High | High | NA | NA – this was a survey study | High- Multiple confounders were adjusted for in the multiple logistic regression models | Low-data from Leicester dataset | Medium |
| 6 | Kennedy 2019 | High | Medium- quasi RCT | Medium- variation in relation to age of attendees versus non-attendees, with attendees being older and therefore more likely to have the medical | NA | High | High | NA | NA | Medium as age and gender were controlled for in the analyses | Low – data from south England | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | conditions of interest | | | | | | | | |
| 2 | McDermott 2018 | Medium | High - RCT | High – age, ethnicity, gender and IMD appeared to be well balanced across groups | High | High | High | High | NA | NA | Low – 18 GP practices in two London boroughs | High |
| 6 | Mytton 2018 | High | High | NA | NA | High | High | NA | NA | NA | High | High |
| 6 | Palladino 2017 | High | Medium – quasi experimental study | Low -can't tell/ not reported | NA | High | High | NA | NA | Low – can't tell | High | Medium |
| 2 | Public Health England 2018 | High | High- RCT | Medium – age and sex were comparable across groups; lack of data were presented re the proportion of additional traits (e.g. ethnicity and deprivation level) across study groups | High | High | High | Medium | NA | NA | Low- practices from Lewisham and Lincolnshire | Medium |
| 6 | Robson 2017 | High | Medium – observational matched study | Medium – females were more likely than males to attend; there was also variation in attendance | NA | High | High | NA | NA | Medium – as females were more likely to attend, thus potentially reducing the perceived | Low – East London GP practices | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | according to ethnicity, however deprivation and age variations were approximately balanced between groups | | | | | | effectiveness of the programme for disease detection as males are more likely to have higher risk of CVD | | |
| 2 | Sallis 2019 | High | High - RCT | Medium- significant differences were found in relation to ethnicity in the SMS pre-notification comparison groups, and WRT sex between groups who received different letter types. Lack of significant difference re other key confounders. | High | High | High | Medium | NA | NA | Low – data from one London borough | Medium |
| 1 | Woringer 2017 | Medium | Low- cross sectional | Medium- No significant differences were found in relation to ethnicity between groups, | NA | High | High | Medium | NA | Medium | High | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | High | | however there were sig difference in age, sex and deprivation level between attendees and the general population | | | | | | | | |
| 4 and 6 | Alageel & Gulliford (2019) | High | Medium | High | NA | High | High | NA | High | Medium | High | High |
| 6 | Chang et al. (2016b) | High | High | High | NA | Medium | High | NA | Medium | High | High | Medium |
| 2 | Gold et al. (2019) | High | Medium | Medium | High | High | High | Medium | NA | NA | Low | High |
| 1 and 6 | Lang et al. (2016) | High | Low | HNA | NA | Medium | High | NA | NA | Medium | Medium | Medium |
| 2 | Whittaker (2019) | High | Low | Low | NA | Medium | Medium | NA | NA | Low | Low | Low |

**Table 1. Objective 1: Are there differences in demographic factors of those attending and not attending an NHS Health Check?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 29 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | none | ⊕⊕◯◯ LOW | IMPORTANT |

a. One study had a quasi-experimental design, the others were observational studies of various designs.

b. A significant proportion of the studies were rated low for baseline imbalances between groups and lack of control for confounding, however the purpose of this question was to assess variations in NHS Health Check attendance versus non-attendance between population sub-groups in relation to social characteristics, therefore imbalances in characteristics between the intervention and control groups were expected and these are likely to reflect reality.

c. Overall the results indicate that older persons and females were most likely to attend an NHS Health check. The results were less consistent in relation to ethnicity. Results tended to vary according to the sample size and geographic coverage of each study. Studies also varied in relation to setting and the cardiovascular risk profile of participants, therefore inconsistencies were not unexplained.

d. The overall sample size is large.

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**Table 2. Objective 2.1: Do socio-demographic factors affect update of the NHS Health Check?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 12 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | none | ⨁⨁◯◯ LOW | IMPORTANT |

a. One study was a randomized controlled trial, one study had a quasi-randomized design; the remaining studies were non-randomized studies, mainly experimental.

b. Six (50%) of the studies received a 'low' rating for domains relevant to the risk of bias, however four of these the issues were in relation to baseline imbalances and confounding, however the purpose of this research objective is to identify sociodemographic differences between attendees and non-attendees. Only two of twelve studies received a low rating for domains relevant to the risk of bias (exposure and outcome measurement and blinding). However, in the context of the NHS Health Checks programme, where the intervention is obvious and data are routinely collected and subject to inaccuracies, these issues don't necessarily indicate poor quality research methods were used.

c. Generally, older persons, females and individuals from least deprived background were most likely to attend NHS Health Checks. The results in relation to ethnic group were mixed. Variations in results across studies are likely to reflect heterogeneity between studies, including different methods and geographical coverage.

d. The sample size overall, across the included studies was large.

**References:**


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**Table 3. Objective 2.2: Do variations to the invitation method affect NHS Health Check attendance? Assessment of quantitative evidence**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 13 | observational studies[a] | serious[b] | not serious[c] | not serious | not serious[d] | None | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. 6 RCTs; N=2 quasi-randomized trials; the remaining studies used observational designs.

b. Most (>50%) of studies scored low for one or more domain that could introduce bias into the study results.

c. The standard national invitation letter was generally associated with reduced uptake compared to variations. The variations differed between studies, therefore differences in relative uptake between groups in each study are expected.

d. The sample size was large (in the thousands) across studies.

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**Table 4. Objective 2.2 Do variations to the invitation method affect NHS Health Check attendance? Assessment of qualitative evidence**

| Finding | Studies contributing to findings (see report reference list) | Methodological limitations | Coherence | Adequacy | Relevance | CERQual assessment of confidence in the evidence | Explanation of CERQUAL assessment |
|---|---|---|---|---|---|---|---|
| Differing views on opportunistic recruitment depending on setting | Greenwich *et al* (2011)<br>Ismail *et al* (2015)<br>Perry *et al* (2014)<br>Riley *et al* (2015) | Most papers were highly rated in terms of quality, with only one being rated overall as medium quality. Two papers scored low in ethical issue and one in rigour | There were no or few concerns identified in any of the papers as they all presented similar data to the findings presented in the review. | Three papers had minor concerns due to not presenting a rich picture of the data gathered. The other had no or few minor concerns | One of the papers had moderate concerns as the quote presented in the review was not clearly linked to the theme and the paper did not otherwise refer to this theme.[51] | Moderate confidence | Reduced grade due to moderate concern and minor concerns around ethical issues and richness of data |
| Benefit of community ambassadors, particularly for ethnic minority groups | Riley *et al* (2015)<br>Stone *et al* (2019) | One paper was medium and one high rated, both scored lower in their description of the relationship between researcher and participants. | There were no or few concerns identified in either paper in this domain. | No or few minor concerns | No or few minor concerns in either paper | High confidence | No reason to downgrade |
| Preference for telephone contact | Stone *et al* (2019)<br>Strutt *et al* (2011)<br>Greenwich *et al* (2011) | Greenwich and Stone medium quality overall, Strutt high quality overall | No coherence concerns | Moderate concern due to richness of data gathered | No concerns | Moderate confidence | Reduced grade due to concerns on richness of data |

**Table 5. Objective 2.3 Does GP practice versus alternative setting affect NHS Health Check uptake?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 2 | observational studies | serious [a] | not serious [b] | not serious | not serious [c] | none | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. Both studies scored low for imbalances in baseline characteristics between groups and confounding.

b. One study reported higher uptake in GP surgeries whereas the other reported similar attendance between settings. This variation is likely to reflect heterogeneity between studies in relation to the population, mode of invitation and the type of non-GP setting in which the NHS Health Checks were performed.

c. Overall sample size across the two studies was large (in the thousands)



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**Table 6. Objective 4 Support for the concept of management of people identified as being at risk of CVD, as an outcome of the NHS Health Checks intervention Assessment of mixed methods evidence.**

| Domain | Assessment of support | Level of support |
|---|---|---|
| Truth value/bias | Inferences and conclusions were reflected in the quantitative and qualitative data. | Moderate |
| Explanation credibility | The issues raised by health professionals were sound. There was a lack of exploration of the reasons why service delivery/ implementation/ follow up, between practices. | Moderate |
| Weakness minimisation | Data in relation to this concept were collected from quantitative, qualitative and mixed methods although the study designs were homogeneous (quant data collected from cross-sectional surveys; qualitative data collected from free text responses and semi-structured interviews). Consistencies were apparent across different study types in relation to variations in service delivery, referrals and follow ups. | Strong |
| Inside-outside | Quantitative and qualitative data were collected, however interview and survey methods may entail responder and reporting biases. Objectivity of these methods is therefore limited. | Low |
| Publication bias | Lack of significance testing therefore it is not possible to assess for this criterion | n/a |
| Additional comments | None | n/a |
| Overall assessment | Moderate | |

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**Table 7. Objective 5 Support for the concept of patient experiences as an outcome of the NHS Health Checks intervention Assessment of mixed methods evidence.**

| Domain | Assessment of support | Level of support |
|---|---|---|
| **Truth value/bias** | Inferences and conclusions made by authors were reflected in the quantitative and qualitative data reported. For example, high levels of satisfaction were evident in the results from quantitative survey data, and participant quotes supported the themes derived by authors.<br>The quantitative data presented from satisfaction surveys were based on questions that were perhaps too broad in focusing on general, overall satisfaction. However, the negative aspects of patients' experiences were captured in the qualitative data.<br>It would have been helpful if the studies which used mixed methods had collected numeric data based on the results from the qualitative methods. For example, by quantifying the number/ proportion of patients who issues expressed through the qualitative data (e.g. how many understood their risk score) | Moderate |
| **Explanation credibility** | The issues regarding patient experiences of the NHS Health Checks programme that were reflected in quotes are understandable (e.g. patient expectations that a 'Health Check' would entail testing for medical conditions not just affecting the cardiovascular system; lack understanding of the risk score). Some studies lacked exploration of the social and psychological mechanisms relating to the issues that patients experienced. For example, the reasons why many attendees would struggle to interpret the risk score. | Moderate |
| **Weakness minimisation** | Supported across limited quantitative (cross-sectional surveys) and several qualitative designs (free-text survey responses; focus groups and interviews). The quantitative data indicate a high level of patient satisfaction, whereas the data from qualitative studies highlight issues with the NHS Health Checks Programme | Inconsistent support |
| **Inside-outside** | The data covers views and quantitative responses from patients. These methods are all at risk of responder bias and may represent the views of those with particularly strong opinions. Objectivity of these methods is therefore limited. | Low |
| **Publication bias** | Lack of significance testing therefore it is not possible to assess for this criterion | n/a |

| | | |
|---|---|---|
| **Additional comments** | None | n/a |
| **Overall assessment** | Low/moderate | |



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**Table 8 Objective 6.1** Are disease detection rates higher for GP practices in areas with high versus low population coverage of the NHS Health Check programme?

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 3 | observational studies[a] | not serious | not serious[b] | serious[c] | not serious[d] | none | ⨁◯◯◯ VERY LOW | CRITICAL |

a. Study descriptions were: quasi-experimental study; non-randomised controlled study and an observational study

b. Palladino (2017) found that high NHS Health Checks program coverage was associated with increased detection of diabetes whereas Lambert (2015) found that increased population coverage of the NHS Health Checks programme was not associated with growth in GP practice disease registers for diabetes. Caley (2014) found no significant associations between % eligible completing an NHS Health Check and change in prevalence of five conditions including diabetes. These variations could reflect ecological effects, attributable to differences in the geographical coverage of each study.

c. The nature of the intervention group varied between studies. For example, Palladino (2017) compared GP practices with high versus medium or low coverage; Lambert (2016) assessed variation in detection rates in relation to number of health checks performed across practices (therefore no binary intervention and control groups) and Calley (2014) compared practices that offered the intervention with control practices which did not.

d. One of the studies (Palladino 2017) used data from a large sample and the confidence intervals did not cross the line of no effect.

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3. Lambert MF. Assessing potential local routine monitoring indicators of reach for the NHS health checks programme. *Public Health* 2016;131:92-8.

**Table 9 Objective 6.1 Are disease detection rates higher amongst those attending an NHS Health Check following an opportunistic versus standard invitation?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 1 | observational studies | not serious[a] | [b] | not serious | serious[c] | none | - | CRITICAL |

a. The study received one low overall rating, however this was in relation to the external rather than internal validity of the study.
b. Not applicable as only one study is included in this GRADE assessment.
c. The sample size was relatively small and the confidence intervals quite wide for >10% CVD risk in this study.

**References**

Gulliford MC, Khoshaba B, McDermott L, et al. Cardiovascular risk at health checks performed opportunistically or following an invitation letter. Cohort study. Journal of public health (Oxford, England) 2018;40(2):e151-e56.

**Table 10 Objective 6.1 Are disease detection rates higher amongst those attending an NHS Health Check versus those who do not attend?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 4 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | strong association[e] | ⨁⨁⨁◯ MODERATE | CRITICAL[f] |

a. One study had a quasi-experimental design, three were cohort studies.
b. None of the studies received low ratings for domains relevant to internal validity/ risk of bias.
c. Overall, the intervention was associated with increased disease detection. Rates for individual diagnoses varied across studies however this is likely to reflect differences between samples, as some studies used national data whereas others used data from regions or smaller spatial units.
d. Some of the studies were small and potentially under powered, however several studies used national data sets and therefore the overall sample size is large. Confidence intervals crossed the line of no effect in some cases however generally, confidence intervals were not large.
e. Robson (2017) reported the rate of chronic kidney disease diagnosis amongst attendees as 83%.
f. The purpose of the NHS Health Checks program is to screen for chronic health conditions.

## References


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2. Robson J, Dostal I, Madurasinghe V, Sheikh A, Hull S, Boomla K, et al. NHS Health Check comorbidity and management: an observational matched study in primary care. Br J Gen Pract. 2017 Feb;67(655):e86-e93.
3. Chang KCM, Lee JT, Vamos EP, Soljak M, Johnston D, Khunti K, et al. Impact of the National Health Service Health Check on cardiovascular disease risk: a difference-in-differences matching analysis. Canadian Medical Association Journal. Jul;188(10):E228-E38.
4. Forster AS, Dodhia H, Booth H, et al. Estimating the yield of NHS Health Checks in England: A population-based cohort study. J Public Heal (United Kingdom) 2015;37:234–40.

**Table 11 Objective 6.2 Does NHS Health Check attendance versus non-attendance influence health-related behaviour (smoking status/ prevalence)?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 5 | observational studies[a] | serious[b] | serious[c] | not serious | Not estimable[d] | none | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. One randomised study and four observational studies.

b. Mode of collection of smoking data wasn't consistently reported, however it is likely to have been self-report and entered into routine medical records which relies on patients both attending the general practice and being asked about their smoking status within that time. Issues associated with self-report data and completeness could introduce biases in relation to the outcome measurement.

c. Although point estimates indicated a reduction in smoking across studies, there were inconsistencies regarding the statistical significance of these effects between studies.

d. Imprecision is not estimable due to differences in effect calculations between studies.



**References**


1. Chang KC, Lee JT, Vamos EP, et al. Impact of the National Health Service Health Check on cardiovascular disease risk: a difference-in-differences matching analysis. *CMAJ* 2016;188(10):E228-E38.
2. Forster AS, Dodhia H, Booth H, et al. Estimating the yield of NHS Health Checks in England: a population-based cohort study. *Journal of public health (Oxford, England)* 2015;37(2):234-40.
3. Alageel S, Gulliford MC. Health checks and cardiovascular risk factor values over six years' follow-up: Matched cohort study using electronic health records in England. *PLoS Med* 2019;16(7):e1002863.
4. Cochrane T, Davey R, Iqbal Z, et al. NHS health checks through general practice: randomised trial of population cardiovascular risk reduction. *BMC Public Health* 2012;12(1):944.
5. Artac M, Dalton AR, Majeed A, Car J, Huckvale K, Millett C. Uptake of the NHS Health Check programme in an urban setting. Family practice. 2013 Aug 1;30(4):426-35.

**Table 12 Objective 6.3 What proportions of NHS Health check attendees receive risk management advice or referrals?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 11 | observational studies[a] | serious [b] | serious[c] | not serious | not serious[d] | none | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. One quasi-randomised controlled trial(Kennedy *et al* 2019)[97]; the remaining studies had an observational design.

b. Two studies (Krska *et al* 2015[23] and Baker *et al* 2015[17]) were rated low on confounding; one study (Foster 2015[13]) was rated low on outcome measurement. These are issues relevant to the internal validity of a study.

c. Large variations existed in the proportions of patients being referred to lifestyle services between studies. This heterogeneity is likely reflective of geographical variations in referrals.

d. The eleven studies which reported relevant data to address the research question were mixed in their coverage; some used national datasets with large sample sizes other studies used regional data. Overall however, the sample size was large. Confidence intervals were not presented for several studies and it is likely that the confidence intervals were large for the regional studies, however in several of the larger studies for which CIs were presented, these were narrow.

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**References**


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2. Robson J, Dostal I, Sheikh A, et al. The NHS Health Check in England: an evaluation of the first 4 years. BMJ Open 2016;6(1):e008840.
3. Cochrane T, Gidlow CJ, Kumar J, et al. Cross-sectional review of the response and treatment uptake from the NHS Health Checks programme in Stoke on Trent. J Public Heal (United Kingdom) 2013;35:92–8.
4. Forster 2015
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6. Baker C, Loughren EA, Crone D, et al. Perceptions of health professionals involved in a NHS Health Check care pathway. Pract Nurs 2015;26:608–12.
7. Coffey M, Cooper AM, Brown TM, et al. Vascular Health Checks in Salford: An exploration using FARSITE data. 2014.
8. Alageel S, Wright A, Gulliford M. Impact of the Health Check programme on the provision of smoking cessation interventions in England. European Journal of Public Health. 2017;27(suppl_3).
9. Alageel S, Gulliford MC. Health checks and cardiovascular risk factor values over six years' follow-up: Matched cohort study using electronic health records in England. PLoS Med 2019;16(7):e1002863.
10. Coghill N. Improving the uptake of NHS Health Checks in more deprived communities using ‘ outreach ’ telephone calls made by specialist health advocates from the same communities : A quantitative service evaluation. 2016.

11. Kennedy O, Su F, Pears R, Walmsley E, Roderick P. Evaluating the effectiveness of the NHS Health Check programme in South England: a quasi-randomised controlled trial. BMJ Open. 2019 Sep 20;9(9):e029420.

**Table 13 Objective 6.4 Does the NHS Health Check versus no NHS Health Check reduce cardiovascular disease risk?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 5[a] | observational studies[b] | serious[c] | not serious[d] | not serious | not serious[e] | none | ⨁◯◯◯ VERY LOW | CRITICAL |

a. One study was a randomized trial, the other four were observational studies.
b. One study had a domain with a low rating - Forster (2015), for outcome measurement. This could affect the internal validity for assessment of the association between NHS Health Checks and CVD risk. Although the other four studies studies were rated as medium or high for this domain, the study by Forster (2015) was the largest study in the analysis and could have impacted significantly on the overall results.
c. Results were generally consistent across studies
d. Decision based on confidence intervals which were reasonably narrow and did not cross the line of no effect. Also, only one of the studies did not use a national data set with a large sample size.
e. Decision based on confidence intervals which were reasonably narrow and die not cross the line of no effect. Also, three of the studies used national data sets with a large sample size.

**References**

1. Artac M, Dalton ARH, Majeed A, et al. Effectiveness of a national cardiovascular disease risk assessment program (NHS Health Check): results after one year. Prev Med (Baltim) 2013;57:129–34
2. Cochrane T, Davey R, Iqbal Z, et al. NHS health checks through general practice: randomised trial of population cardiovascular risk reduction. BMC Public Health 127 2012;12:944.
3. Forster AS, Burgess C, Dodhia H, et al. Do health checks improve risk factor detection in primary care? Matched cohort study using electronic health records. J Public Health(Bangkok) 2015;:1–8.
4. Chang K, Lee J, Vamos E, et al. Impact of the National Health Service Health Check. CMAJ 2016;188:E228-238.
5. Alageel S, Gulliford MC. Health checks and cardiovascular risk factor values over six years' follow-up: Matched cohort study using electronic health records in England. Plos Medicine. Jul;16(7):16.

**Table 14. Objective 6.5 Does the NHS Health Check versus no NHS Health Check increase prescribing of statins or antihypertensive medication?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 16 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | none | ⨁⨁◯◯ LOW | IMPORTANT |

a. One study was a randomised trial, the remaining 15 had an observational design

b. The only study that received a low rating for a domain relevant to risk of bias was Krska 2016 which scored low for confounding. As other studies scored medium or high on this domain, it was deemed that risk of bias overall wouldn't be significantly affected.

c. Most studies show an increase in prescribing following the NHS Health Check. The exception is Alageel 2019 in relation to prescribing of anti-hypertensive medication.

d. Although variations in effect estimates are present between studies, this heterogeneity may be attributable to factors including different sample sizes and differences in study designs. The confidence intervals reported appear reasonably small and do not cross the line of no effect.

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4. Forster AS, Burgess C, Dodhia H, et al. Do health checks improve risk factor detection in primary care? Matched cohort study using electronic health records. Journal of Public Health 2015;38(3):552-59.
5. Jamet G, Tubeuf S, Meads D. Leeds Institute of Health Sciences Has the introduction of NHS health checks increased the prescription of statins for CVD prevention? 2014.
6. Robson J, Dostal I, Madurasinghe V, et al. NHS Health Check comorbidity and management : an observational matched study in primary care. Br J Gen Pract Published Online First: 2016.
7. Artac M, Dalton ARH, Majeed A, et al. Effectiveness of a national cardiovascular disease risk assessment program (NHS Health Check): results after one year. Prev Med (Baltim) 2013;57:129–34.
8. Chang KC-M, Soljak M, Lee JT, et al. Coverage of a national cardiovascular risk assessment and management programme (NHS Health Check): Retrospective database study. Prev Med (Baltim) 2015;78:1–8.

9. Dalton AR, Bottle A, Okoro C, et al. Uptake of the NHS Health Checks programme in a deprived, culturally diverse setting: cross-sectional study. Journal of public health (Oxford, England) 2011;33(3):422-9.
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15. Cochrane T, Gidlow CJ, Kumar J, et al. Cross-sectional review of the response and treatment uptake from the NHS Health Checks programme in Stoke on Trent. Journal of public health (Oxford, England) 2013;35(1):92-8.
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# NHS Health Check programme: A rapid review update.

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| | |

# NHS Health Check programme: A rapid review update.

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# Abstract

**Objective:** To update a rapid review published in 2017, which evaluated the NHS Health Check Programme.

**Methods:** An enlarged body of evidence was used to re-address six research objectives from a rapid review published in 2017, relating to the uptake, patient experiences and effectiveness of the NHS Health Check Programme. Data sources included Medline, PubMed, Embase, Health Management Information Consortium (HMIC), Cumulative Index of Nursing and Allied Health Literature (CINAHL), Global Health, PsycInfo, the Cochrane Library, NHS Evidence, Google Scholar, Google, Clinical Trials.gov and the ISRCTN registry, Web of Science, Science Citation Index, The Cochrane Library, NHS Evidence, Open Grey and hand searching article reference lists. Screening, data extraction and quality appraisal using the Critical Appraisals Skills Programme checklists were performed in duplicate. Grading of Recommendations, Assessment, Development and Evaluations was implemented. Data were synthesised narratively.

**Results:** 697 studies were identified, and 29 new studies included in the review update. The number of published studies on the uptake, patient experiences and effectiveness of the NHS Health Check Programme has increased by 43% since the rapid review published in 2017. However, findings from the original review remain largely unchanged, which may reflect the larger number of studies included (n=68). NHS Health Checks led to an overall increase in the detection of raised risk factors and morbidities including diabetes mellitus, hypertension, raised blood pressure, cholesterol and chronic kidney disease. Individuals most likely to attend the NHS Health Check Programme included females, persons aged ≥60 years and those from more socioeconomically advantaged backgrounds. Opportunistic invitations increased uptake amongst males, younger persons and those with a higher deprivation level.

**Conclusions:** Although results are inconsistent between studies, the NHS Health Check programme is associated with increased detection of heightened CVD risk factors and diagnoses. Uptake varied between population subgroups. Opportunistic invitations may increase uptake.

## Strengths and limitations of this study

- This review summarises newly identified evidence evaluating the NHS Health Check (NHS-HC) Programme, building on an earlier rapid review published in 2017.
- The methods involved searches of published and grey literature sources, duplicate blinded screening, data extraction and quality appraisal and assessment of the quality of the overall body of evidence for each objective.
- Meta-analysis was not feasible due to the heterogeneous nature of the included studies.
- The results indicate that the NHS-HC programme increases the detection of individuals at risk of cardiovascular disease and that inequalities exist in NHS-HC attendance between population sub-groups. Opportunistic invitations could increase uptake amongst these under-represented demographic groups.
- The overall body of evidence addressing the review objectives were 'very low' to 'moderate' quality therefore caution should be used when interpreting findings.

## Introduction

The NHS Health Check (NHS-HC) Programme is a cardiovascular disease (CVD) prevention programme introduced in 2009 aiming to assess all adults in England aged between 40 and 70 years old for CVD risk factors including obesity, physical inactivity, smoking and high alcohol consumption, high blood pressure and high cholesterol. Following assessment, using established tools, the level of individual risk is communicated to patients and evidence-based risk reduction interventions are implemented where appropriate.[1 2]

An important aspect of the NHS-HC is the long-term goal of reducing inequalities in premature deaths from cardiovascular disease, although the how was not explicitly stated.[3] An observational study which used records from 9.5 million patients reported that NHS-HC attendees were more likely to be older and women, but were similar in terms of ethnicity and deprivation, compared with non-attendees.[4] To address NHS-HC provider concerns [5] regarding equity of access and to achieve the aim of reducing inequalities in premature CVD deaths, potential discrepancies in equity of access and outcomes must be identified and addressed.

Cost-effectiveness of the NHS-HC has been a focal point for discussion. Original modelling estimated the programme could prevent 1,600 heart attacks and strokes, at least 650 premature deaths, and over 4,000 new cases of diabetes each year, with an estimated cost per quality adjusted life year (QALY) of approximately £3,000.[6] Since then, it has been suggested that the programme is wasting large amounts of money (~£450million).[7] However, some evidence suggests the checks may be cost-effective, with small changes in BMI equating to a small but positive QALY gain of 0.05 per participant (cost-effectiveness ratio of £900/QALY).[8] Additionally, such programmes could potentially be cost saving in the future if they correctly identify large numbers of people with CVD risk.[9]

Given these challenges it is important to consistently update and review available evidence to assess the impact of NHS-HC and the extent to which it is meeting the goal of addressing health inequalities. Additionally, a review of the NHS-HC programme was announced in the Government's prevention green paper[10] and this evidence review was undertaken with the intention of informing that review and potential changes to policy. We therefore aimed to update a previously completed rapid synthesis of published research evidence on the NHS-

HC Programme, which incorporates evidence from studies published up to 9th November 2016.[1] The main findings of this earlier review included that NHS-HCs are associated with small increases in disease detection. Higher attendance (number of attendees as a function of those who are eligible) was found among older people, women, the most deprived populations (which may reflect targeting), and non-smokers. Take-up (number of attendees as a function of those who are invited) of an NHS-HC varied between population sub-groups, with older persons, women in younger age groups, men in older age groups, and people from the least deprived areas were more likely to attend. People did not take up the offer of an NHS-HC due to factors including lack of awareness of the service, competing priorities and difficulty with getting a GP appointment. Of those who attended NHS-HC, satisfaction levels were high. Methods which could increase uptake are invitation modifications and text message invitations or reminders. Health professionals expressed concerns regarding inequalities in uptake of the programme and the clinical and cost-effectiveness of NHS-HC.

The rapid review reported here aimed to update the aforementioned review, using the same objectives (as stated below).

## Objectives

Our aim was to update an earlier rapid review[1] and summarise newly identified evidence addressing the following research objectives:

1. Who is and who is not having an NHS Health Check (NHS-HC)?
2. What are the factors that increase take-up among the population and sub-groups?
3. Why do people not take up an offer of an NHS-HC?
4. How is primary care managing people identified as being at risk of cardiovascular disease or with abnormal risk factor results?
5. What are patients' experiences of having an NHS-HC?
6. What is the effect of the NHS-HC on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and on statin and anti-hypertensive prescribing?

## Methods

A rapid review update reported according to the Preferred Reporting Items for Systematic

Reviews and Meta-Analyses (PRISMA) guidelines. A checklist of PRISMA items is presented in the online supplementary file S1.[11]

## Patient and public involvement

No patients involved.

## Literature searches

The following databases were searched, from January 1996 to November 2016 in the earlier review[1] and from Jan 2016 to Dec 2019 for this update: Medline, PubMed, Embase, Health Management Information Consortium (HMIC), Cumulative Index of Nursing and Allied Health Literature (CINAHL), Global Health, PsycInfo, the Cochrane Library, NHS Evidence, Google Scholar, Google, Clinical Trials.gov and the ISRCTN registry, Web of Science, Science Citation Index and OpenGrey. Hand searching of key article reference lists was also completed. The search strategy is available in the online supplementary file S2.

## Study selection

Studies from the earlier review[1] were included in the review update. The studies from updated searches were split into batches and each record was independently reviewed by two authors (either RPWK, LMT or LMT, FP) based on title, abstract and full text using pre-specified inclusion and exclusion criteria (available in the online supplementary file S3) to identify those eligible for inclusion in the update. Conflicts were resolved through discussion, with adjudication by a third reviewer (either FP or RBG depending on who had not previously reviewed the record) where necessary.

## Data extraction

A random sample of 10% of the data extraction completed in the original review [1] was checked by LT and found to be consistent with information reported in the primary studies. Data from newly identified studies were extracted onto pre-specified, piloted, data pro-formas (available in the online supplementary files S4 and S5). Data from each quantitative study was extracted by a single reviewer (either RPWK or LT). Extracted data were then checked for accuracy by a different reviewer (either RPWK or LT). Any conflicts were resolved through discussion or via adjudication by a third reviewer (FP) when necessary. Pertinent qualitative data including direct quotes, meanings, concepts and themes were extracted in duplicate (by MS and FP) with discrepancies discussed and resolved. Duplicate extraction was completed for each qualitative paper by two reviewers from differing standpoints so as not to subconsciously affect the data being extracted and synthesised.

## Quality appraisal

The quality of newly identified studies was assessed by a single reviewer then verified by a second. Any discrepancies were resolved through discussion and, where required, adjudicated by a third reviewer. Qualitative studies were assessed by MS or FP using The Critical Appraisal Skills Programme (CASP) checklist for qualitative research.[12] Quantitative studies were assessed by RPWK or LT using a tool that was developed using CASP tools[12] and implemented by the previous review authors[1] to accommodate the range of study designs included.

## Data synthesis

Synthesis of new quantitative and qualitative data was completed as an extension to that undertaken in the original review. Numerical data were combined using a structured, narrative synthesis. Meta-analysis was not methodologically appropriate due to high heterogeneity and a low number of high-quality studies reporting on each objective in a consistent manner. For the qualitative data, a three-stage thematic synthesis approach[13] was planned in which newly identified studies could add to and potentially revise the original findings. This approach involves 'line-by-line' coding of the findings according to the content and meaning; developing 'descriptive themes' by grouping codes according to similarities and differences; generating 'analytical themes' based on the reviewer's interpretation of the data in relation to the research question. [13]

## Assessment of the certainty of the evidence

GRADE,[14] GRADE-CERQual[15] and a method for assessing certainty of evidence in mixed methods reviews[16] were used to assess the certainty and confidence in quantitative, qualitative and mixed methods evidence, respectively, contributing to each objective and sub-objective as appropriate.

# Results

The PRISMA flow diagram of included and excluded studies is shown in Figure 1. Twenty-nine newly identified studies were eligible for inclusion. The numbers of newly identified studies mapping to each research objective are as follows: objective 1 (n=6), objective 2 (n=9), objective 3 (n=0), objective 4 (n=4), objective 5 (n=2) and objective 6 (n=13). Quality appraisal scores for each study are shown in supplementary file S6. GRADE assessments are shown in supplementary file S7. The overall certainty of evidence ranged from 'very low' to 'moderate'. Results are also synthesised below in relation to each objective and sub-objective.



Please insert Figure 1 here

***Objective 1: Differences in demographics of those attending and not attending an NHS-HC***

NHS digital and Public Health England (PHE) published attendance data from 2012 to 2018.[17] The national average attendance was 44.2%, with variation across regions (range = 41.3-49.2%). The variation was greater at a local authority level where 2017-18 attendance varied from 19.5% to 75.8%. The original review identified 24 studies for this objective. This update identified 6 new studies.

Generally, more older adults (e.g. > 60 years old) attended than younger adults.[18-20] Evidence suggested males are less likely to attend than females,[17-19 21 22] as statistically evidenced in [21] (AOR: 0.75, 95% CI: 0.67-0.84) and [19] (AOR: 0.73, 95% CI: 0.67-0.8). Another study [20] however, provide some evidence that males may be more likely to attend than females when the NHS-HCs were conducted opportunistically, where health checks are offered to patients during face-to-face medical consultations for other reasons.

Attendance data regarding ethnic groups is inconclusive. The NHS Digital data[17] shows that over the time period of 2012-2018, those of an Asian or Black background had greater numbers of attendance than not attendance. Whilst those of a white British background had a greater number of non-attendees compared to attendees. However, this varied greatly by year with no single ethnic group consistently attending more often than not attending. [17 18] The authors of one study, [18] however, claim that white British had greater attendance at a national level but given that white British make up most of the eligible population this finding could be misleading. Attendance by ethnicity probably varies depending upon location. For example, community data from Leicester showed that non-white people were more likely to attend than white people.[20] In terms of socio-economic status, there is some evidence those from a higher level of deprivation (identified by IMD) are less likely to attend an NHS-HC.[19 20] However, opportunistic NHS-HCs show an increase in attendance from those of a higher deprivation level.[22]

There is evidence to suggest lower levels of NHS-HC attendance among smokers.[20 21] One study [20] also reported the effect of religion on attendance, suggesting higher attendance of non-Christians than Christians. Those with no religious background were less likely to attend overall. This finding was from a single small community-based study and it is, therefore, difficult to make any inferences about the wider population.

The GRADE certainty in evidence rating for Objective 1 was 'low' due to the observational nature of study designs that contributed evidence.

***Objective 2: What factors increase take-up among population and sub-groups?***

Uptake has maintained a range of 45-50%, with recent national data from PHE reporting an uptake of 45.9% for 2018/2019.[23] There are, however, variations by region and constituency. For example, in the North East uptake varied between 25% and 61%.

*Objective 2.1 Socio-demographic determinants of uptake*

There were 11 quantitative studies included in the original review. We identify one new quantitative study conducted in two London boroughs (18 GP practices) reporting socio-demographic differences in uptake.[24] A randomised control trial (RCT) assessing uptake via standard invitation letter or a question behaviour effect (QBE) questionnaire (with/without financial incentive) followed by the invitation letter. Uptake across the three trial arms was 15.3%. This is significantly lower than previously reported (27% in [25]; 34.1% in [26] and 44.8% in [27]). One study [24] also found males and younger people less likely to attend an NHS-HC. Those with a non-white ethnic background were more likely to attend, however, this study area includes a large proportion of individuals from a non-white ethnic background and results may not be reflective of the wider population. Contradictory to Objective 1 findings, those from the second least deprived quintile were more likely to attend than those from the most deprived.

*Objective 2.2 Invitation methods*

Six new studies, adding to seven previously identified, assess the effects of different invitation methods, compared to the standard invitation letter, on uptake.[24 28-32] Use of the QBE questionnaire alone or with a financial incentive (£5) did increase uptake when it was returned. There were, however, no statistically significant changes in risk difference between the two invitation types (1.52%, 95% CI: -0.03 to 3.07%, $p = 0.054$). This is lower than previous research estimating a 3-4% change.[33] One study compared the use of modified letters and telephone invitations.[30] While a different study compared a letter with yes/no SMS pre and post invitation.[32] Another study implemented new shorter leaflet styles (two vs four pages) but there were no statistically meaningful changes in uptake.[31] Use of SMS reminders and time limited letters did, increase uptake;[31] confirming the positive results previously reported in a similar study. [34] Telephone invitations also improved uptake compared to the standard letter invitation and a personalised CVD risk.[30] A cost analysis suggests that for every 1000 patients invited by telephone (compared to standard letters) an additional 180 NHS-HCs could be expected, with an extra cost of £0.24/patient. Telephone invitations are also strongly preferred by primary care and outreach workers.[35] Finally, the use of opportunistic invitations compared with the standard invitation letter improved uptake of those identified at greater CVD risk (i.e. risk score 10%).[29] Using opportunistic invitations also lead to an increase in younger patients attending.[22]

*Objective 2.3 Setting*

This update identified two quantitative studies which assessed the impact of setting on uptake rates; none were identified in the earlier review. These studies compared a GP setting to an outreach service[36] or community pharmacy.[37] One of the studies targeted hard-to-reach groups using opportunistic methods. While GP attendance was three times more than the outreach services, people of a South Asian ethnicity and higher IMD were more likely to attend the outreach services.[36] Males, however, were more likely to attend a GP than an outreach or community pharmacy service.[36 37] The other study found minimal differences in uptake of NHS-HCs after invitation by letter.[37] Opportunistic methods may provide greater uptake in some harder-to-reach patients.

The GRADE certainty in evidence ratings for Objectives 2.1-3 ranged from 'low' due to the observational nature of study designs to 'very low' due to high risk of bias ratings.

***Objective 3: Why do people not take up an offer of an NHS-HC?***

No new studies identified addressed this objective.

***Objective 4: How primary care is managing people identified as being at risk of CVD or with abnormal risk factor results***

The only study across both reviews to focus on risk management was [38]. They assessed CVD risk factors in England over a six-year follow-up period. An interrupted time series analysis (ITS) revealed mean Body Mass Index (BMI) following a health check was 0.3kg/m$^2$ (95% CI: 2-0.39kg/m$^2$) lower, while control patients' (no health check) BMI increased (0.08kg/m$^2$, 95% CI: 0.07-0.09kg/m$^2$ per year).[38] Additionally, after the six-year period, patients who had a health check were less likely to be smokers (AOR: 0.9, 95% CI: 0.87-0.94). NHS-HC attendees also had lower systolic and diastolic blood pressure, and lower total cholesterol.[38] High density lipoprotein was, however, slightly higher after six-years (0.01, 95% CI: 0.002-0.02). This single large study provides evidence that NHS-HCs can increase provision of risk management advice and interventions.

Fifteen qualitative studies were identified by the previous review, a further three are presented here. Three qualitative studies[35 39 40] investigated the views of those responsible for delivery of NHS-HCs. Healthcare professionals interviewed by [39] suggested that an NHS-HC was unlikely to be successful because people already knew the positive health behaviours they needed to engage with, but chose to ignore public health messaging. In a later study[40] it was found that GPs seemed more negative towards delivery of NHS-HCs than other staff.

NHS-HCs were seen as time consuming or unclear in terms of outcome. Several GPs felt that it would be more efficient if health care assistants (HCAs) conducted the NHS-HC as the HCAs role is more focused on health promotion activities so they are more likely to have the opportunity and skills to elicit more personal information from patients. In contrast, HCAs were unsure if they had the right skills to undertake NHS-HCs, and indeed, whether this should be part of their role. One study found health professionals thought it was beneficial to have someone from a similar ethnic background invite a patient for an NHS-HC, as they understood how certain elements of the NHS-HC would relate to specific communities.[35] They also identified that employing outreach workers freed up GP and practice staff time to focus on other tasks. However, as outreach staff worked across multiple practices in the district, some practice managers were negative about the system as it meant they did not operationally manage them.

The certainty in evidence rating for Objective 4 was 'moderate'. Lack of objectivity was the main area of concern across studies addressing this objective.

***Objective 5: Patient views on NHS-HCs***

One study found patients felt a sense of obligation to attend and be "a willing patient", but family history affected how likely they were to make a change.[41] Some pointed to longevity in their family as a reason to avoid changing their health behaviours, others felt that as family members had high risk of CVD disease, it was inevitable they too would experience high risk, regardless of any behaviour change. In two studies by the same author [39 40] patients could not recall a specific risk score but did remember discussions around their current state of health. People felt more able to make changes when their family and friends supported and facilitated them to do so. Individuals valued being able to use their results from their NHS-HC to converse with their support networks identifying and introducing changes to their behaviours. Whilst one patient found the form filling and nature of the questioning to be off-putting,[41] the majority felt the experience of having a health check was positive.

The certainty in evidence rating for Objectives 5 was 'low' due to the subjective nature of participant data, to 'moderate'.

***Objective 6: Effects of the NHS-HC Programme on health outcomes***

Studies mapped to Objective 6 assessed the effects of the NHS-HC on one of the following predefined health outcomes: disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and statin and antihypertensive prescribing.

*Objective 6.1 Disease detection*

Seventeen studies reported data on disease detection, five of these were newly identified. One of the newly identified studies used data from 455 GP practices across England.[42] Incidence rates of detected non-diabetic hyperglycaemia and type 2 diabetes were significantly higher amongst individuals registered at GP surgeries with high NHS-HC coverage, compared to low coverage surgeries. Rates of non-diabetic hyperglycaemia were reported to be 19% higher in the high coverage compared to the low coverage group (Hazard Ratio (HR) 1·19, 95% confidence interval (CI) 1·01 to 1·41) and rates of type 2 diabetes were 10% higher (HR 1·11, 95% CI 1·03 to 1·19).[42]

Four studies used samples from smaller areas of England. One of the studies reported that individuals who received opportunistic NHS-HCs offered during patient encounters for other reasons, were significantly more likely to have a higher 10-year risk of CVD (CVD risk score ≥ 10%, assessed using the Joint British Societies' 'JBS3' risk calculator) compared to individuals who chose to attend following an invitation.[29] Two studies reported that NHS-HC attendance compared to non-attendance was associated with significant increase in detection or diagnosis of the following conditions: CVD risk > 10%;[43] diabetes and hypertension,[43 44] total cholesterol[43] and chronic kidney disease (CKD).[44] A different study compared disease detection rates between NHS-HC attendees from different socioeconomic groups and reported a significant increase in the detection of CVD risk > 20% amongst individuals from the most deprived IMD decile.[21]

*Objective 6.2 Health-related behaviours*

Five studies (one newly identified) reported data on health-related behaviours. The newly identified study used national (England) data from the Clinical Practice Research Datalink dataset. NHS-HC participants were less likely to be smokers compared to a control group after six years' follow-up (health check 17% versus controls 25%; odds ratio (OR) 0.90, CI 0.87 to 0.94, p < 0.001) however, a greater reduction in smoking prevalence was reported for the control group.[38]

*Objective 6.3 Risk management referrals*

Ten studies (four newly identified) reported data quantifying the proportion of NHS-HC attendees who were referred to lifestyle services. Two of the new studies used data from across England,[40 45] one study involved a sample of 151 general practices in Hampshire [43]and the other from 38 GP practices in Bristol.[19]

The proportions of NHS-HC attendees who were offered risk management advice or referrals varied between studies and in relation to the risk factor addressed, from 1.8-90% for smoking cessation interventions, < 1 % to 73% for weight management interventions among patients with a BMI of ≥ 30, and between 0.01%, and 33.9% for interventions to reduce alcohol consumption amongst patients who consumed ≥ 14 units per week. This is likely reflective of geographical variations in referrals between areas.

*Objective 6.4 CVD risk*

Five studies (one newly identified) assessed the change in CVD risk factor values following the NHS-HC. The newly identified study used national data from across England. Adjusted mean differences in 10-year CVD risk scores between intervention recipients and non-recipients at six years post-NHS-HC, were as follows: body mass index ($Kg/m^2$) -0.30 (95% CI -0.39 to -0.20, p<0.001); systolic blood pressure (mean, mm Hg) -1.43 (95% CI -1.70 to –1.16, p<0.001); diastolic blood pressure (mean, mm Hg) -0.93 (95% CI -1.11 to -0.75, p<0.001) total cholesterol (mean, mmol/L) – 0.05 (95% CI -0.07 to – 0.03, p<0.001), high density lipoprotein cholesterol (mean, mmol/L) 0.01 (95% CI 0.002 to 0.02, p>0.05).[38]

*Objective 6.5 Prescribing of statins and anti-hypertensives*

Sixteen studies (four newly identified) reported data on prescribing after the implementation of NHS-HC. One of the newly identified studies which used national data from across England reported that NHS-HC participants were more likely to receive statins (HR 1.24, 95% CI 1.21 to 1.27, p < 0.001) and were less likely to receive antihypertensive drugs (HR 0.86, 95% CI 0.85 to 0.88, p < 0.001) compared to non-attendees.[38] One study found that new statin prescriptions were higher for NHS-HC attendees compared to non-attendees.[44] The proportions of new statin prescriptions administered to NHS-HC attendees versus non-attendees were 11.5% and 8.2%, respectively. These data were from 143 general practices in three clinical commissioning groups (CCGs) in east London (England, UK). A different study also reported that NHS-HCs led to increased use of statins (OR 1.54, 95% CI 1.39 to 1.71) in addition to antihypertensives (OR 1.15, 95% CI 1.06 to 1.24) using data from 151 GP practices in Hampshire.[43] Another study compared prescribing rates between population sub-groups (male/female and age group) among NHS-HC attendees using data from GP practices in Bristol.[19] The results indicated that women were more likely than men to be prescribed a cardiovascular drug, (OR 1.18, 95% CI 1.03 to 1.35) as were patients aged ≥ 70 years compared to aged ≤70 years (OR 1.64, 95% CI 1.14 to 2.35). In the same study, individuals classified as being at high risk of CVD were most likely to be prescribed CVD medication (OR 6.16, 95% CI 4.51 to 8.40). There was no evidence of any association between the prescribing of CVD medication and socioeconomic status or ethnicity.

*Objective 6.6 Economic modelling studies*

Six studies (three newly identified) assessed the cost-effectiveness of the NHS-HC Programme based on different implementation approaches. Two of the new studies, which are related, assessed implementation and re-design scenarios using demographic data from Liverpool's population, exposure to risk factors and CVD epidemiology to assess health benefits, equity and cost effectiveness.[46 47] The third study assessed whether the impact of the checks on BMI was sufficient to justify its costs.[48] The two related studies reported that the equitability and cost-effectiveness of the NHS-HC Programme would be increased through the addition of policies targeting dietary consumption and through combining current provision with targeting of the intervention in deprived areas. [46 47] The third study reported that even modest changes in BMI from the NHS-HC Programme are associated with significant cost-saving benefits making the programme cost-effective.[48]

The GRADE certainty in evidence ratings for Objectives 6.1-5 ranged from 'very low' due to risk of bias, indirectness, imprecision and inconsistency, to 'moderate'.

## Discussion

The goal of the NHS-HC Programme is to identify and reduce CVD risk in those aged between 40 and 74 years. This rapid review aimed to update existing evidence on a previously completed review.[1]

*Principal findings*

The proportion of published studies has increased by 43% since the earlier review.[1] However, the majority of the key findings from the original review remain unchanged in this review update. The overall results from the earlier review and the review update are summarised as follows for each objective along with the findings from a body of relevant evidence identified prior to the publication of this review:

Objective 1 *Who is and who is not having an NHS-HC?* There is higher NHS-HC attendance among women and people aged 60 years and over. The association between female gender and NHS-HC attendance was confirmed by a newly identified study.[49] The evidence synthesised in this review indicated that smokers and those from high levels of deprivation are least likely to take up an invitation to attend an NHS Health Check, although a more recent study on over 9.5 million people reported no significant evidence of inequity of attendance by deprivation level.[4] There is mixed evidence regarding the association between ethnicity and NHS-HC attendance. Newly located studies report higher attendance among South Asian ethnic groups [49] and people with serious mental illnesses.[50]

Objective 2 *What are the factors that increase take-up among the population and sub-groups?* Opportunistic invitations, telephone invitations and text message reminders increased uptake compared to the standard invitation letters. Additionally, delivery setting influenced uptake in population subgroups, with people of a South Asian ethnicity and higher IMD more likely to attend the outreach services.(35) An RCT published in 2021 found that automated prompts to clinical staff to invite patients to NHS-HCs, delivered via computer systems in general practice, improved uptake, especially for men and younger patients.[51]

Objective 3 *Why do people not take up an offer of an NHS-HC?* The earlier review [1] reported that lack of awareness or knowledge, competing priorities, misunderstanding the purpose, an aversion to preventive medicine, difficulty getting an appointment with a GP, and concerns about privacy and confidentiality reduced NHS-HC attendance among the general population. A newly identified study, published in 2020, identified barriers to NHS-HC uptake amongst prisoners, which included poor accessibility to the healthcare department, stigma of visiting healthcare and fear surrounding the NHS-HC.[52]

Objective 4 *How is primary care managing people identified as being at risk of cardiovascular disease or with abnormal risk factor results?* We found variations in risk management referrals across the reviewed studies, possibly reflecting geographic variations. A newly retrieved study reported that overall fidelity of delivery of NHS-HCs in general practice was high, however, important elements of the NHS-HC, including assessments in relation to ethnicity and family history of disease, in addition to the Alcohol Use Disorders Identification Test and dementia risk management, were being regularly omitted.[53] Another new study found that practitioners often demonstrated limited understanding and confidence in explaining the 10-year risk score to patients, whereas confidence in the JBS3 lifetime

CVD risk calculator, with its visual information summaries, was higher.[54]

Objective 5 *Patient views on the NHS-HC Programme:* Overall patient satisfaction levels with the programme were high, however the risk score was less helpful to patients than discussion about their health with the clinician during the NHS-HC. Although more recent research suggests that visual representations of CVD risk were more easily understood than a percentage risk score.[55] Behaviour change may be influenced by perceived risk based on family history and social support. A newly identified study reported that participants did not like the form-filling aspect of the NHS-HC.[56]

Objective 6 *What is the effect of the NHS-HC on disease detection…?*

Overall, the NHS-HC programme is associated with increased detection of CVD risk factors and diagnoses, increased prescribing of cardiovascular medications and with a general reduction in CVD risk factors. The results from two newly identified studies confirmed these findings.[49 57] The economic evidence indicated that the cost-effectiveness of the NHS-HC programme varies; population-wide interventions were more cost-effective than individual level interventions and interventions targeted at deprived areas were more cost-effective compared to non-targeted interventions. A study published in 2020 found that people with serious mental illnesses were more likely to: attend an NHS-HC; have higher rates of CKD and type 2 diabetes; and have received treatment with statins and anti-hypertensive medication, compared to people without these conditions.[50]

*Strengths and weaknesses of the study*

The methods utilised to review the evidence available on the NHS-HC Programme involved searches of published and grey literature sources, duplicate blinded screening, data extraction and quality appraisal and assessment of the quality of the overall body of evidence for each objective. Methods used to synthesise the new data with the existing body of evidence were appropriate given the quantity and types of new studies identified. Review limitations included that it was not possible to perform meta-analysis due to the heterogeneous nature of the included studies. The use of 'vote counting' methods potentially compromises the precision of the results.[58]

*Strengths and weaknesses of the available evidence*

General consistency of findings across studies in relation to each review objective supports causal inferences regarding the direction of effect of the NHS-HC Programme on the health-related outcomes assessed. The overall quality of evidence varied between objectives and ranged from 'very low' to 'moderate', reflecting issues including that most studies were observational with confounding and poor internal validity (assessed using risk of bias). Furthermore, inconsistent data collection and reporting across many of the studies reduces precision of estimated effect of the NHS-HC Programme on health-related outcomes.

*Implications for policy and practice*

The results from this review could inform changes to the methods used to invite eligible individuals to attend an NHS-HC, for example by modifying the invitation method (e.g. telephone invitations and sending text message reminders). Opportunistic recruitment could be used to selectively target specific groups who are at greater risk, as well as those who are less likely to engage with the NHS-HC Programme.

*Unanswered questions and future research*

There is a need to understand more fully the effect of the programme on lifestyle behaviours including further research to explore the impact of attending an NHS-HC on physical activity, diet, and alcohol consumption. The identified barriers to the uptake of an NHS-HC need to be explored in more depth as they could inform improvement of recruitment to the programme. In particular, future research should examine the potential of NHS-HC to widen inequalities given the demographics of participants identified in our review. A review of interventions for CVD (e.g. physical activity or diet change), outside of the NHS-HC Programme could help inform further development of the programme.

*Conclusions*:

The NHS-HC programme increases the detection of individuals at risk of cardiovascular disease. The overall body of evidence addressing the review objectives were 'very low' to 'moderate' quality therefore caution should be used when interpreting findings, which appear to show that inequalities exist in NHS-HC attendance between population sub-groups. There are also geographical variations rates of referral to lifestyle services following NHS-HC. Targeting NHS-HC towards high-risk communities (e.g. deprived communities) may increase the cost-effectiveness of the programme. Uptake may be increased through opportunistic invitations in addition to addressing misconceptions regarding the purpose, importance and confidential nature of the programme. Discussion between NHS-HC attendees regarding their health and their GP may be more helpful than receiving a risk score, which may not be understood or remembered by the patient. Family history of disease and social support could determine the impact of the intervention on behaviour change.

**Figures** Figure 1 PRISMA Flow Chart depicting the flow of included and excluded studies.

**Contributors** FP, KT and RBG conceptualised and design the review. Literature searches were designed and implemented by Public Health England's Information Specialist Team and FP. FP, LT, RBG and RPWK reviewed titles, abstracts and full-text papers for eligibility. FP, LT, MS, RBG and RPWK completed data extraction and quality appraisal. The manuscript was prepared by FP, LT, MS and RPWK. JL, KT and RBG provided critical revision.

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**Research Ethics Approval:** This was a review update for which secondary data from published studies were synthesised. As such, we did not collect primary data from human participants or animals for this study.

**Data sharing statement:** Supplementary material are saved on the Figshare online open access repository, and are accessible via the following link: https://figshare.com/s/6b42c2162ca607d46c11

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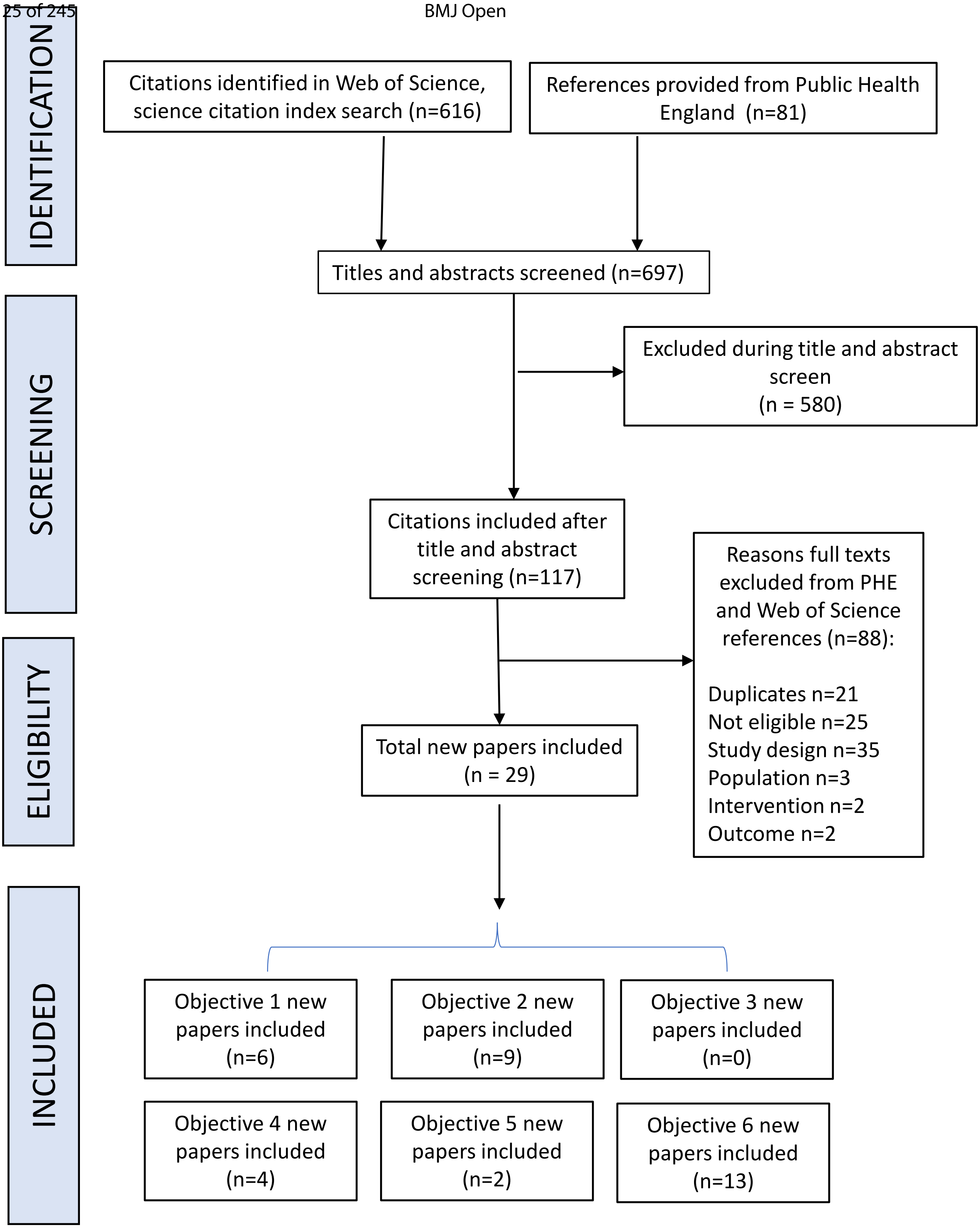


**Figure 1: PRISMA flow chart depicting the flow of included and excluded studies.**

# PRISMA 2009 Checklist

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a systematic review, meta-analysis, or both. | Page 1 |
| **ABSTRACT** | | | |
| Structured summary | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | Page 2 |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. | Pages 2 and 5 |
| Objectives | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | Page 5 |
| **METHODS** | | | |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | NA |
| Eligibility criteria | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | supplementary data S3 |
| Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | Pages 2 and 6 |
| Search | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | supplementary data file S2 |
| Study selection | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | Page 6 |
| Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | Page 6 |
| Data items | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | supplementary files 4 and 5 |
| Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | Page 7; supplementary file 6 |
| Summary measures | 13 | State the principal summary measures (e.g., risk ratio, difference in means). | NA |

# PRISMA 2009 Checklist

| | | | |
|---|---|---|---|
| Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$) for each meta-analysis. | Page 7 |



| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). | Pages 7-15; Supplementary files 6 and 7 |
| Additional analyses | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. | NA |
| **RESULTS** | | | |
| Study selection | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. | Figure 1 (page 8) |
| Study characteristics | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | Pages 7-15 |
| Risk of bias within studies | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12). | Supplementary files 6 and 7 |
| Results of individual studies | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. | Pages 7-15 |
| Synthesis of results | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency. | NA |
| Risk of bias across studies | 22 | Present results of any assessment of risk of bias across studies (see Item 15). | Pages 7-15 |
| Additional analysis | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). | NA |
| **DISCUSSION** | | | |
| Summary of evidence | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | Pages 2 and 15-18 |
| Limitations | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). | Pages 17-18 |
| Conclusions | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | Page 18 |
| **FUNDING** | | | |

# PRISMA 2009 Checklist

| | | | |
|---|---|---|---|
| Funding | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. | 19 |

*From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

| Database | Search strategy |
|---|---|
| Ovid Medline | 1. health check*.tw.<br>2. (diabetes adj3 screen*).tw.<br>3. (cardiovascular adj3 screen*).tw.<br>4. (population adj2 screen*).tw.<br>5. (risk factor adj3 screen*).tw.<br>6. (opportunistic adj3 screen*).tw.<br>7. medical check*.tw.<br>8. general check*.tw.<br>9. periodic health exam*.tw.<br>10. annual exam*.tw.<br>11. annual review*.tw.<br>12. NHSHC.tw.<br>13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12<br>14. cardiovascular adj3 prevention.tw.<br>15. (primary care or general practice or primary healthcare).tw<br>16. 14 and 15<br>17. Cardiovascular Diseases/ AND Primary Prevention/<br>18. 16 or 17<br>19. 13 or 18 |
| PubMed | 1. health check*<br>2. diabetes screen*<br>3. cardiovascular screen*<br>4. population screen*<br>5. risk factor screen*<br>6. opportunistic screen*<br>7. medical check*<br>8. general check*<br>9. periodic health exam*<br>10. annual exam*<br>11. annual review*<br>12. NHSHC<br>13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12<br>14. Cardiovascular Diseases AND Primary Prevention[MeSH Terms]<br>15. "primary care"[Text Word] OR "general practice"[Text Word] OR "primary healthcare"[Text Word])<br>16. (cardiovascular[Text Word] AND prevention[Text Word])<br>17. #15 and #16<br>18. #14 or #17<br>19. #13 or #18 |
| Ovid Embase | 1. health check*.tw.<br>2. (diabetes adj3 screen*).tw.<br>3. (cardiovascular adj3 screen*).tw.<br>4. (population adj2 screen*).tw. |

| | |
|---|---|
| | 5. (risk factor adj3 screen*).tw.<br>6. (opportunistic adj3 screen*).tw.<br>7. medical check*.tw.<br>8. general check*.tw.<br>9. periodic health exam*.tw.<br>10. annual exam*.tw.<br>11. annual review*.tw.<br>12. NHSHC.tw.<br>13. periodic medical examination/<br>14. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13<br>15. cardiovascular adj3 prevention.tw.<br>16. (primary care or general practice or primary healthcare).tw<br>17. 15 and 16<br>18. cardiovascular disease/ AND primary prevention/<br>19. 17 or 18<br>20. 14 or 19 |
| Ovid HMIC | 1 "health check*".af.<br>2 health checks/<br>3 (cardiovascular or vascular or heart or diabetes or stroke).af.<br>4 (screen* or risk).af.<br>5 3 AND 4<br>6 1 OR 2 or 5<br>7 cardiovascular adj3 prevention.tw.<br>8 (primary care or general practice or primary healthcare).tw<br>9 7 and 8<br>10 Cardiovascular diseases/ AND exp preventive medicine/<br>11 9 or 10<br>12 6 or 11 |
| EBSCO CINAHL | S10 S1 OR S2 OR S9<br>S9 S5 OR S8<br>S8 S6 AND S7<br>S7 (MH "Preventive Health Care+")<br>S6 (MH "Cardiovascular Diseases+")<br>S5 S3 AND S4<br>S4 "primary care" or "general practice" or "primary healthcare"<br>S3 TX cardiovascular N3 prevention<br>S2 (diabetes N3 screen*) OR (cardiovascular N3 screen*) OR<br>(population N2 screen*) OR (risk factor N3 screen*) OR (opportunistic<br>N3 screen*) OR “medical check*” OR “general check*” OR “periodic<br>health exam*” OR “annual exam*” OR "annual review*" OR NHSHC |

| | |
|---|---|
| | S1 health check* |
| EBSCO Global Health | S10 S6 OR S19 OR S3 Limiters - Publication Year: 2016<br>S9 S7 AND S8<br>S8 DE "preventive medicine"<br>S7 DE "cardiovascular diseases"<br>S6 S4 AND<br>S5 S5 "primary care" or "general practice" or "primary healthcare"<br>S4 TX cardiovascular N3 prevention<br>S3 S1 OR S2 131<br>S2 (diabetes N3 screen*) OR (cardiovascular N3 screen*) OR (population N2 screen*) OR (risk factor N3 screen*) OR (opportunistic N3 screen*) OR “medical check*” OR “general check*” OR “periodic health exam*” OR “annual exam*” OR "annual review*" OR NHSHC<br>S1 health check* |
| HDAS PsycInfo | 1 "health check*".af.<br>2 PHYSICAL EXAMINATION/<br>3 HEALTH SCREENING/<br>4 "diabetes screen*".af<br>5 "cardiovascular screen*".af<br>6 "population screen*".af<br>7 ("opportunistic* screen*" OR "risk factor screen*").af<br>8 ("medical check*" OR "general check*" OR "periodic health exam*" OR "annual exam*" OR "annual review*" OR NHSHC).af<br>9 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8<br>10 cardiovascular.ti,ab<br>11 prevention.ti,ab<br>12 10 AND 11<br>13 CARDIOVASCULAR DISORDERS/<br>14 PREVENTIVE MEDICINE/<br>15 13 AND 14 16 12 OR 15 17 9 OR 16 |
| Web of Science, Science Citation Index | “health check*” OR “diabetes screen*” OR “cardiovascular screen*” OR “population screen*” OR “risk factor screen*” OR “Opportunistic screen*” OR “medical check*” OR “general check*” OR “periodic health exam*” OR “annual exam*” OR “annual review*” OR NHSHC OR (Cardiovascular NEAR/3 prevention) AND (“primary care” OR “general practice” OR “primary healthcare”) Limit to: England, Scotland, Wales, North Ireland |
| Cochrane Library (Wiley) | #1 "health check*" #2 (diabetes next/3 screen*) or (cardiovascular next/3 screen*) or (population next/2 screen*) or (opportunistic next/2 screen*) or ("risk factor" next/3 |

| | |
|---|---|
| | screen*) or "medical check*" or "general check*" or "periodic health exam*" or "annual exam*" or "annual review*" or NHSHC #3 cardiovascular adj3 prevention.tw. #4 (primary care or general practice or primary healthcare).tw #5 #3 and #4 #6 MeSH descriptor: [Cardiovascular Diseases] this term only #7 MeSH descriptor: [Primary Prevention] explode all trees #8 #6 and #7 #9 #5 or #8 #10 #1 or #2 or #9 |
| NHS Evidence | "health check*" OR cardiovascular prevention primary care |
| TRIP database | "health check*" OR cardiovascular prevention primary care |
| Google Scholar | "nhs health check" cardiovascular "health check" cardiovascular prevention "primary care" |
| Google | "nhs health check" cardiovascular prevention "primary care" cardiovascular "health check" |
| Clinical trials.gov and ISRCDN registry | "health check" |

**PHE NHS health checks inclusion/exclusion criteria**

**Study Type Inclusion Criteria**

All studies must have included the NHS Health Check. Primary studies and guidelines will be included. Primary studies should have one of the following designs:

- RCT or cluster RCT
- Quasi RCT or cluster quasi RCT
- Controlled and uncontrolled pre- post-studies with appropriate comparator groups
- Interrupted time series
- Cohort studies (prospective and retrospective
- Case-control studies
- Qualitative studies from any discipline or theoretical tradition using recognised qualitative methods of data collection and analysis
- Economic and health outcome modelling

**Study Type Exclusion Criteria**

Editorials, commentaries and opinion pieces will be excluded

Table of inclusion and exclusion characteristics for each objective.

| Objective number | One | Two | Three | Four | Five | Six |
|---|---|---|---|---|---|---|
| **Question** | **Who is and who is not having an NHS health check** | **What factors increase take up among population and sub-groups** | **Why do people not take up an offer of an NHS health check** | **How is primary care managing people identified as being at risk of CVD or with abnormal risk factor results** | **What are patients' experiences of having an NHS health check** | **What is the effect of the NHS health check on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and on statin and antihypertensive prescribing** |
| **Research type** | Quantitative | Qualitative/Quantitative | Qualitative | Qualitative/Quantitative | Qualitative | Quantitative |
| **Included participants** | UK population eligible for NHS health checks (aged 40-74yrs) | UK population invited for NHS health checks | UK population eligible but not attending health checks | Primary care services across the UK providing health checks | UK population attending health checks | UK population eligible for NHS health checks |
| **Included measurements for extraction** | Demographics, patient condition characteristics (e.g. BMI, smoking status, CVD risk factors, etc) | Patient characteristics (subgroups, protected characteristics), setting characteristics (any health care), mode of delivery, booking system, cell/recall methods, take up rates, use of point of care testing, etc | Patient opinions, attitudes and experiences of health checks, choices made and why, reasons and beliefs underlying decisions. | Provider management protocols, recall methods, provider experiences of programme provision, referrals to lifestyle services, prescribing statins or anti-hypertensives, further investigations, adherence to guidelines etc | Patient opinions and experiences of health checks | Disease and condition detection rates, including hypertension, diabetes, chronic kidney disease, AF, familial hypercholesterolemia, peripheral vascular disease etc, behaviour change, referrals to local risk management services, reductions in individual risk factor prevalence or CVD risk, statin and anti-hypertensive prescribing, any other physical or mental health outcomes, cost effectiveness |
| **Exclusions** | Participants not eligible for health checks or receiving other forms of health check or screening services | Patients not eligible for health checks or taking up other forms of health check or screening services | Patients not eligible for health check or choosing not to take up other forms of health check or screening services | Primary care services not offering NHS health checks or people identified as at risk for CVD outside NHS health checks | Patients who have not had an NHS health check | Patients not eligible for an NHS health check |

| | Study inforr | |
|---|---|---|
| **Author (date)** | **Setting** | **Study time period** |

| mation | | |
|---|---|---|
| **Study type** | **Notes** | **Eligible population sampled (if not reported then attended an NHS health check population shown in brackets** |

| | | | Overall D |
|---|---|---|---|
| Age range | Age mean | age median | SD |

**)emographics**

| SE | IQR | Gender (n and %) |
|---|---|---|

| Ethnicity (n and %) | IMD score (n and %) | Notes |
|---|---|---|

| Attended health check (n) | Age (Range) | age mean | age median | SD | SE |
|---|---|---|---|---|---|

| | | | | | Age analysis | | | |
|---|---|---|---|---|---|---|---|---|
| IQR | Did not attend health check (n) | Age (Range) | age mean | age median | SD | SE | IQR | |

| Odds ratio (adjusted) | 95% CI | p-value | Chi square distribution males by age | df |
|---|---|---|---|---|

| p-value | Chi-square distribution females by age | df | p-value | Uptake % | direction of result |
|---|---|---|---|---|---|

| Gender analysis | | | | | |
|---|---|---|---|---|---|
| Notes | Males attended (n and %) | Males not attending (n and %) | Females attended (n and %) | Females not attending (n and %) | Odds ratio (adjusted) |

| 95% CI | p-value | Attending Ethnicity (n and %) | Not attending ethnicity (n and %) |
| --- | --- | --- | --- |

| Odds ratio (adjusted) | 95% CI | p-value | chi-square distribution by age male |
|---|---|---|---|

**Ethnicity analysis**

| df | p-value | chi-square distribution by age female | df |
|---|---|---|---|

| p-value | uptake % Male | uptake % Female |
|---|---|---|

| Attended Quintile 1 (n and %) | did not attend quintile 1 | Odds ratio | 95% CI |
|---|---|---|---|

| p-value | Attended Quintile 2 | did not attend quintile 2 | Odds ratio |
|---|---|---|---|

| 95% CI | p-value | Attended Quintile 3 | did not attend quintile 3 |
|---|---|---|---|

| Index of multiple deprivation (1st quintile = least depreived, 5th = most deprived) | | | |
|---|---|---|---|
| **Odds ratio** | **95% CI** | **p-value** | **Attended Quintile 4** |

| did not attend quintile 4 | Odds ratio | 95% CI | p-value |
|---|---|---|---|

| Attended Quintile 5 | did not attend quintile 5 | Odds ratio | 95% CI |
|---|---|---|---|

| p-value | not recorded attended | not recorded not attended | overall IMD |
|---|---|---|---|

| Religion | | | |
|---|---|---|---|
| Attended religious background | did not attend religious backgroung | Odds ratio | 95% CI |

| p-value | attended never smoked | not attended never smoked | odds ratio | 95% CI |
|---|---|---|---|---|

| | | | smoking analysis | | |
|---|---|---|---|---|---|
| p-value | attended ex-smoker | not attended ex-smoker | odds ratio | 95% CI | p-value |

| attended current smoker | did no attend current smoker | odds ratio | 95% CI |
|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| p-value | north east attendees | north east non-attendees | p-value | North west attendees |

| north west non-attendees | p-value | yorkshire and humber attendees | yorkshire and humber non-attendees | p-value |
|---|---|---|---|---|

| Region | | | | |
|---|---|---|---|---|
| east midlands attendees | east midlands non-attendees | p-value | west midlands attendees | west midlands non-attendees |

**nal analysis**

| p-value | east of england attendees | east of england non-attendees | p-value | south west attendees | south west non-attendees |
|---|---|---|---|---|---|

| p-value | south central attendees | south central attendees | p-value | london attendees | london non-attendees |
|---|---|---|---|---|---|

| p-value | south east coast attendees | south east coast non-attendees | p-value |
|---|---|---|---|

| Author (date) | Trial registration | Setting |
|---|---|---|

| Study information | | | |
|---|---|---|---|
| Study time period | Study type (e.g. RCT) | Intervention 1 description (NB: one of these will be standard practice, just state) | Intervention 2 |
| | | | |

| Intervention 3 | Notes | Overall sample size | Age (Range) |
|---|---|---|---|
| | 0.00 to 0.03 | | |

| Overall Demographics | | | |
|---|---|---|---|
| Age mean | Age median | SD | SE |
| | | | |

| IQR | Gender (n and %) | Ethnicity (n) | Sample size |
|---|---|---|---|
| | | | |

| | | | | |
|---|---|---|---|---|
| | | | | Ir |
| Age (Range) | Age mean | age median | SD | |
| | | | | |

**ntervention 1 demographics**

| SE | IQR | Gender (n and %) | Ethnicity (n) |
|---|---|---|---|
| | | | |

| IMD (n and %) | uptake % | Sample size | Age (Range) |
|---|---|---|---|
| | | | |

| Age mean | age median | SD | SE | IQR |
|---|---|---|---|---|
| | | | | |

**Intervention 2 demographics**

| Gender (n and %) | Ethnicity (n) | Checks in people registered at DQ5 (deprived) |
|---|---|---|
| | | |

| IMD (n and %) | uptake % | Sample size | Age (Range) |
|---|---|---|---|
| | | | |

| Intervention 3 demographics | | | | |
|---|---|---|---|---|
| age mean | age median | SD | SE | IQR |
| | | | | |

| Gender (n and %) | Ethnicity (n) | uptake % |
|---|---|---|
| | | |

| Notes | intervention differences z-score | p-value |
|---|---|---|
| | | |

| intervention differences chi-squared | df | p-value | age chi-squared |
|---|---|---|---|
| | | | |

| | | | Results |
|---|---|---|---|
| p-value | gender chi-squared | p-value | IMD chi-square |
| | | | |

| p-value | ethnicity chi-squared | p-value | intervention Adjusted Odds ratio | 95% CI |
|---|---|---|---|---|
| | | | | |

| p-value | Gender AOR | 95% CI | p-value | Age AOR |
|---|---|---|---|---|
| | | | | |

| 95% CI | p-value | IMD AOR | 95% CI | p-value |
|---|---|---|---|---|
| | | | | |

| Author (date) | Setting | Study type | Study time period |
| --- | --- | --- | --- |

| follow up (if applicable) | Inclusion criteria |
|---|---|

| Study information | |
|---|---|
| Exclusion criteria | Control Cohort criteria (if applicable) |

| | |
|---|---|
| Notes | mean dif between cases and controls |

| 95% CI | p-value | Mean change per year for cases and controls |
|---|---|---|

| 95% CI | p-value | 1st year after health check | 95% CI |
|---|---|---|---|

| BMI ITS analysis | | | | |
|---|---|---|---|---|
| p-value | 2nd year after health check | 95% CI | p-value | 3rd year after health check |

| 95% CI | p-value | 4th year after health check | 95% CI | p-value |
|---|---|---|---|---|

| 5th year after health check | 95% CI | p-value | 6th year after health check | 95% CI |
|---|---|---|---|---|

| p-value | mean dif between cases and controls | 95% CI | p-value | Mean change per year for cases and controls |
|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | Current : |
| 95% CI | p-value | 1st year after health check | 95% CI | p-value | 2nd year after health check | 95% CI |

| smoking - Odds Ratio | | | | | |
|---|---|---|---|---|---|
| p-value | 3rd year after health check | 95% CI | p-value | 4th year after health check | 95% CI |

| | | | | | | |
|---|---|---|---|---|---|---|
| **p-value** | **5th year after health check** | **95% CI** | **p-value** | **6th year after health check** | **95% CI** | **p-value** |

| mean dif between cases and controls | 95% CI | p-value | Mean change per year for cases and controls | 95% CI |
|---|---|---|---|---|

| p-value | 1st year after health check | 95% CI | p-value | 2nd year after health check | 95% CI |
|---|---|---|---|---|---|

| Systolic BP | | | | | |
|---|---|---|---|---|---|
| p-value | 3rd year after health check | 95% CI | p-value | 4th year after health check | 95% CI |

| p-value | 5th year after health check | 95% CI | p-value | 6th year after health check | 95% CI |
|---|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| **p-value** | **mean dif between cases and controls** | **95% CI** | **p-value** | **Mean change per year for cases and controls** |

| 95% CI | p-value | 1st year after health check | 95% CI | p-value | 2nd year after health check |
|---|---|---|---|---|---|

| Diastolic BP | | | | | |
|---|---|---|---|---|---|
| 95% CI | p-value | 3rd year after health check | 95% CI | p-value | 4th year after health check |

| 95% CI | p-value | 5th year after health check | 95% CI | p-value | 6th year after health check |
|---|---|---|---|---|---|

| | | | | |
|---|---|---|---|---|
| 95% CI | p-value | mean dif between cases and controls | 95% CI | p-value |

| Mean change per year for cases and controls | 95% CI | p-value | 1st year after health check | 95% CI |
|---|---|---|---|---|

| Total cholesterol | | | | | |
|---|---|---|---|---|---|
| p-value | 2nd year after health check | 95% CI | p-value | 3rd year after health check | 95% CI |

| p-value | 4th year after health check | 95% CI | p-value | 5th year after health check | 95% CI |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **p-value** | **6th year after health check** | **95% CI** | **p-value** | **mean dif between cases and controls** | **95% CI** |

| p-value | Mean change per year for cases and controls | 95% CI | p-value | 1st year after health check |
|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| | | | HDL cholesterol | | |
| **95% CI** | **p-value** | **2nd year after health check** | **95% CI** | **p-value** | **3rd year after health check** |

| 95% CI | p-value | 4th year after health check | 95% CI | p-value | 5th year after health check |
|---|---|---|---|---|---|

| 95% CI | p-value | 6th year after health check | 95% CI | p-value |
|---|---|---|---|---|

| Author (date) | Setting |
|---|---|

| Study type | Study time period |
| --- | --- |

| Study information | |
|---|---|
| follow up (if applicable) | Inclusion criteria |

| Exclusion criteria | Control Cohort criteria (if applicable) |
|---|---|

| Notes | Eligible population sampled (if not reported then attended an NHS health check population shown in brackets) | age mean |
|---|---|---|

| age median | SD | SE | IQR |
| --- | --- | --- | --- |

| Overall/intervention Demog | | |
|---|---|---|
| Age ranges (n and %) | Gender (n and %) | IMD quintiles (n and %) |

graphics

| BMI mean | SD | BMI >/= 25 | systolic BP mean | SD |
|---|---|---|---|---|

| diastolic BP mean | SD | hypertension | Total cholesterol mean | SD |
|---|---|---|---|---|

| TC >/=5mmol | % of smokers | HbA1c (glucose) mean |
|---|---|---|

| SD | prescribed statin | exercise grading low |
|---|---|---|

| | | |
|---|---|---|
| **Ethnicity (n and %)** | **Control sample size** | **age mean** |

| age median | SD | SE | IQR |
|---|---|---|---|

| Age ranges (n and %) | Gender (n and %) | IMD quintiles (n and %) | BMI mean |
| --- | --- | --- | --- |

Control Demographics (if applicable)

| SD | BMI >/= 25 | systolic BP mean | SD |
|---|---|---|---|

| diastolic BP mean | SD | hypertension | TC >/= 5 mmol |
|---|---|---|---|

| % of smokers | prescribed statin | exercise grading low | Ethnicity (n and %) |
|---|---|---|---|

| Notes | health check patients (n and %) | control patients (n and %) |
|---|---|---|

| attendees pre intervention prescribed statins % | attendees post intervention prescribed statins % | difference between attendees by t-test |
|---|---|---|

| 95% CI | non-attendees pre intervention prescribed % | non-attendees post intervention prescribed % |
|---|---|---|

| difference between non attendees by t-test | 95% CI | crude DID (attendees vs non-attendees) |
|---|---|---|

| 95% CI | DID matched (attendees vs non-attendees) | 95% CI |
|---|---|---|

| Adjusted HR | 95% CI | p-value |
|---|---|---|

| Statin prescribed | | |
|---|---|---|
| Number at high risk of CVD (>20%) | Number perscribed statins at high risk (n and %) | high risk by age (overall n) |

| prescribed by age (n and %) | high risk by gender (overall n) | prescribed by gender(n and %) |
|---|---|---|

| high risk by ethnicity (overall n) | prescribed by ethnicity (n and %) | Maximum number of patients (n) |
|---|---|---|

| Age | Gender (n and %) | Ethnicity (n and %) | IMD quintiles (n and %; quintile 1 = least depreived) |
|---|---|---|---|

| Qrisk (n and %) | Crude OR | Complete cases (n) | Age | Gender |
|---|---|---|---|---|

| Ethnicity (n and %) | Deptrivation index (n and %) | Qrisk (n and %) | Adjusted OR | 95% CI |
|---|---|---|---|---|

| p-value | Notes | health check patients (n and %) | control patients (n and %) | Adjusted HR |
|---|---|---|---|---|

| 95% CI | p-value | pre intervention attendees prescribe antihypertensives % |
| --- | --- | --- |

| post intervention attendees prescribed antihypertensives % | differences by attendees t-test | 95% CI |
|---|---|---|

| Antihypertensives prescribed | | |
|---|---|---|
| pre intervention non-attendees prescribed antihypertensives % | post intervention non-attendees prescribed antihypertensives % | differences by attendees t-test |

| 95% CI | crude DID (attendees vs eligible non-attendees) | 95% CI |
|---|---|---|

| DID matched (attendees vs matched non-attendees) | 95% CI | adjusted HR |
|---|---|---|

| | | |
|---|---|---|
| **95% CI** | **p-value** | **Notes** |

| Referral to service health check patients (n and %) | referral to service control patients (n and %) | HR |
|---|---|---|

| 95% CI | p-value | given advice health check patients (n and %) |
|---|---|---|

| | | |
|---|---|---|
| | | V |
| given advice control patients (n and %) | HR | 95% CI |

| Veight management interventions | | |
|---|---|---|
| p-value | Given medication health check patients (n and %) | given medication control patients (n and %) |

| HR | 95% CI | p-value |
|---|---|---|

| Health check patients receiving all interventions (n and %) | control patients receiving all interventions (n and %) | HR |
|---|---|---|

| 95% CI | p-value | Notes |
|---|---|---|

| given advice (n and %) | Referral to service health check patients (n and %) | referral to service control patients (n and %) |
|---|---|---|

| HR | 95% CI | p-value |
|---|---|---|

| Given medication health check patients (n and %) | given medication control patients (n and %) | HR |
|---|---|---|

| 95% CI | p-value | attendees given advice |
|---|---|---|

| Smoking cessation intervention | | |
|---|---|---|
| Health check patients receiving all interventions (n and %) | control patients receiving all interventions (n and %) | HR |

| 95% CI | p-value | attendees smoking prevalence pre(%) |
|---|---|---|

| attendees smoking prevalence post (%) | difference by t-test | 95% CI |
|---|---|---|

| non-attendees smoking prevalence pre (%) | non-attendees smoking prevalence post (%) | difference by t-test |
|---|---|---|

| 95% CI | Crude DID | 95% CI |
|---|---|---|

| DID matched | 95% CI | Notes |
|---|---|---|

| type 2 diabetes diagnosis (overall n) | prescribed medication (n and %) | diabetes education provided (n and %) |
|---|---|---|

| type 2 diagnosis by gender (overall n) | medication by gender (n and %) | education by gender (n and %) |
|---|---|---|

| type 2 diagnosis by ethnicity (overall n) | medication by ethnicity (n and %) | education by ethnicity (n and %) |
|---|---|---|

| Diabetes interventions | | |
|---|---|---|
| type 2 diagnosis by age (overall n) | medication by age (n and %) | education by age (n and %) |

| high risk of type 2 diabetes (overall n) | prescribed medication (n and %) | high risk by gender (overall n) |
|---|---|---|

| medication by gender (n and %) | high risk by ethnicity (overall n) | medication by ethnicity (n and %) |
| --- | --- | --- |

| | | |
|---|---|---|
| high risk by age (overall n) | medication by age (n and %) | attendees before intervention mean score |

| SD | attendees post intervention mean | SD |
|---|---|---|

| difference by paired t-test | 95% CI | non-attendees before intervention mean |
|---|---|---|

| Qrisk analysis | | |
|---|---|---|
| SD | non-attendees post mean | SD |

| difference by paired t-test | 95% CI | Crude difference by difference |
|---|---|---|

| | | |
|---|---|---|
| **95% CI** | **DID matching estimator** | **95% CI** |

| Notes | Maximum number of patients (n) | Age | Gender | Ethnicity (n and %) |
|---|---|---|---|---|

| Refer | | | | |
|---|---|---|---|---|
| Deptrivation index (n and %; quintile 1 = least depreived) | Qrisk (n and %) | Crude OR | Complete cases (n) | Age |

**rral to other services**

| Gender | Ethnicity (n and %) | Deptrivation index (n and %) | Qrisk (n and %) | Adjusted OR | 95% CI |
|---|---|---|---|---|---|

| p-value | advice given about alcohol (n and %) | referral for alcohol (n and %) | advice about exercise (n and %) | referral for exercise (n and %) |
|---|---|---|---|---|

| Notes | attendees post BMI | SD | t-test | 95% CI |
|---|---|---|---|---|

| non-attendees post BMI | SD | t-test | 95% CI | crude DID |
|---|---|---|---|---|

| 95% CI | DID matched | 95% CI | attendees post systolic | SD |
|---|---|---|---|---|

| t-test | 95% CI | non-attendees post systolic | SD | t-test |
| --- | --- | --- | --- | --- |

| Post scores for other fac | | | | |
|---|---|---|---|---|
| 95% CI | crude DID | 95% CI | DID matched | 95% CI |

ctors

| attendees post diastolic | SD | t-test | 95% CI | non-attendees post diastolic |
|---|---|---|---|---|

| SD | t-test | 95% CI | curde DID | 95% CI |
|---|---|---|---|---|

| DID matched | 95% CI | Attendees post total cholesterol | SD | t-test |
|---|---|---|---|---|

| 95% CI | non-attendees post total cholesterol | SD | t-test | 95% CI |
|---|---|---|---|---|

| crude DID | 95% CI | DID matched | 95% CI |
|---|---|---|---|

| Notes | attendees hypertension detected (>/= 140/90) Men |
|---|---|

| non-attendees hypertension detected (>/= 140/90) Men | difference (HC - controls %) |
| --- | --- |

| difference (inequality %) | attendees hypertension detected (>/= 140/90) Women |
|---|---|

| non-attendees hypertension detected (>/= 140/90) Women | difference (HC - controls %) |
|---|---|

| difference (inequality %) | attendees Hypercholesterolaemia detected (>5mmol/l) Men | non-attendees Hypercholesterolaemia detected (>5mmol/l) Men |
|---|---|---|

| difference (HC - controls %) | difference (inequality %) | attendees Hypercholesterolaemia detected (>5mmol/l) women |
|---|---|---|

| Detecti | | |
|---|---|---|
| non-attendees Hypercholesterolaemia detected (>5mmol/l) women | difference (HC - controls %) | difference (inequality %) |

| tion rates | |
|---|---|
| attendees current smoking detected Men | non-attendees current smoking detected Men |

| difference (HC - controls %) | difference (inequality %) | attendees current smoking detected Women |
|---|---|---|

| non-attendees current smoking detected Women | difference (HC - controls %) | difference (inequality %) |
| --- | --- | --- |

| attendees BMI >/= 30 detected Men | non-attendees BMI >/= 30 detected Men | difference (HC - controls %) |
|---|---|---|

| difference (inequality %) | attendees BMI >/= 30 detected Women | non-attendees BMI >/= 30 detected Women |
|---|---|---|

| difference (HC - controls %) | difference (inequality %) | Number attending screening by IMD |
|---|---|---|

| Number at high risk of CVD by IMD | CVD/CHD/stroke diagnoses attendees | Diabetes register growth (%) |
|---|---|---|

| diabetes register growth regression | Hypertension register growth (%) | hypertension register growth regression |
|---|---|---|

| Regression analysis | | |
|---|---|---|
| incident cases of hypertension regression (initial) | incident cases of hypertension regression (validation) | High CVD risk detected regression |

| completeness of hypertension registrs | deprivation IMD | IMD adjusted OR | 95% CI |
|---|---|---|---|

| p-value | Age Adjusted OR | 95% CI |
| --- | --- | --- |

| CVD risk factors analysis | | | | | |
|---|---|---|---|---|---|
| p-value | practice IMD adjusted OR | 95% CI | p-value | Gender adjusted OR | 95% CI |

| p-value | smoking status adjusted OR | 95% CI | p-value |
|---|---|---|---|

## NHS HEALTH CHECK RAPID REVIEW UPDATE: Qual Data Extraction Tool

To avoid bias 3 reviewers from diverging perspectives and research backgrounds will extract data. Qualitative information on experiences of minority issues from the point of view of participants and professionals will be particularly sought and extracted. CASP will be used to extract quality data.

To include qualitative studies from any discipline or theoretical tradition using recognised qualitative methods of data collection and analysis.

## 2. What factors increase take-up among population and sub-groups?



**Inclusion:** UK population attending Health Checks**,** Patient characteristics (including subgroups, protected characteristics),
**Measures:** Setting characteristics, (e.g. GP practice, size, pharmacy, etc), Mode of delivery, booking system, call/ recall methods, take up rates, use of point of care testing, etc.
**Exclusion:** Patients not eligible for an NHS Health Check or taking up other forms of health check or screening services

| Author/Year | Type of Report | Study Period | Study Location | NHS Health Check setting | Data Collection Method | N of participants | Method of recruitment to study | Participant characteristics | Overall quality |
|---|---|---|---|---|---|---|---|---|---|

| Author/Year | | Population | Subgroup | Practitioner |
|---|---|---|---|---|
| | Description of Popn/Sub-group/Practitioner | | | |
| | Attitudes towards NHS Health checks | | | |
| | Experiences of invitation process | | | Telephone outreach calls. |

**As appropriate map commentaries extracted to themes 1-5**
**Views of attendees on different invitation method. Three main themes described:**
1) Differing views on opportunistic recruitment depending on setting
2) Benefit of community ambassadors, particularly for ethnic minority groups
3) Preference for telephone contact

**Views of attendees on different setting. Two main themes emerged**:

4) Convenience of settings outside general practice
5) Sense of duty to attend general practice-based NHS Health Checks

## 3. Why do people not take-up an offer of an NHS Health Check?

**Inclusion:** UK population eligible for but not attending Health Checks
**Measures:** Patient opinions, perception of attitudes and experiences of NHS Health Checks and how those are formed including internal and external influences, choices made and why, reasons and beliefs underlying decisions
**Exclusion:** Patients not eligible for an NHS Health Check or taking up other forms of health check or screening services

| Author/Year | Type of Report | Study Period | Study Location | NHS Health Check setting | Data Collection Method | N of participants | Method of recruitment to study | Participant characteristics | Overall quality |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| Author/Year | | Population | | Practitioner |
|---|---|---|---|---|
| | Description of popn/practitioner | | | |
| | Attitudes towards NHS Health checks | | Views on uptake of NHS Health Checks | |
| | Experiences of invitation and appointment booking process | | | |

**As appropriate map commentaries extracted to themes 1-6**
1) Lack of awareness or knowledge
2) Time constraints or competing priorities
3) Misunderstanding the purpose
4) Aversion to preventive medicine

5) Difficulty with access in GPs
6) Concern around the pharmacy as a setting

## 4. How is primary care managing people identified as being at risk of CVD or with abnormal risk factor results?

**Inclusion:** Primary care services across the UK providing NHS Health Checks
**Measures:** Provider management protocols, recall methods, provider experiences of programme provision, referrals to lifestyle services, prescribing statins or anti-hypertensives, further investigations, adherence to guidelines, etc
**Exclusion:** Primary Care services not offering NHS Health Checks or people identified as at risk for CVD outside NHS Health Checks

| Author/ year | Type of report | Study period | Location of study | Setting of NHS Health Check | Data collection method | n | Method of recruitment to study | Participant characteristics | Overall quality |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| Author/Year | | Patient* | Provider* | Practitioner* |
|---|---|---|---|---|
| | Describe Patient group/ Provider/Practitioner | | | |
| | Experiences of programme provision | | | |
| | Experiences of those responsible for delivery | | | |

**As appropriate map studies reporting on**
**Delivery to:**
1) Variation in delivery, recall and f/u
2) Variation in lifestyle advice provided and service availability

**Health Care Professionals Perspectives to:**
1) Concerns about inequality of uptake

2) Doubts about long term cost-effectiveness
3)

**Pharmacist Views to:**

1) Impact for staff/pharmacy rather than delivery
   a. job satisfaction
   b. promoting pharmacy image
   c. staff development
2) Main challenges identified to implementation within pharmacies by healthcare professionals
   a) Lack of time / need for support staff
   b) Funding
   c) Training
   d) Limited private space for consultations
   e) Difficulties with IT
   f) Difficulty recruiting participants

**Challenges to implementation of NHS Health Checks within general practice to:**

1) Difficulties with IT and computer software
2) Impact on practice workload
3) Funding
4) Difficulty getting people to make changes to their lifestyle
5) Limited access to follow-up lifestyle services
6) Inadequate training

## 5. What are patients' experiences of having an NHS Health Check?

**Inclusion:** UK population attending Health Checks
**Measures:** Patients opinions and experiences of NHS Health Checks
**Exclusion:** Patients who have not had an NHS Health Check

| Author/ year | Type of report | Study period | Location of study | Setting of NHS Health Check | Data collection method | n | Method of recruitment to study | Participant characteristics | Overall quality |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |

| Author/Year | | Patient |
|---|---|---|
| | Describe Patient group/recruitment | |
| | Opinions and experiences of NHS Health Checks | |
| | Satisfaction | |

**As appropriate map studies reporting on:**

1) Additional check expectations (Well Woman, Diabetes, Cancer, well-being, ECG, Anaemia, chronic conditions, impact on daily life of chronic conditions
2) Limited understanding of the risk score (no recall of provision, no comprehension of score, false comprehension of score)
3) Quality of information (format, detail and personalisation)
4) Potential Trigger for behaviour change/actual behaviour change
5) Confusion around follow-up

**CASP QUALITY APPRAISAL FORM**

https://casp-uk.net/wp-content/uploads/2018/03/CASP-Qualitative-Checklist-2018_fillable_form.pdf

| Objective | Author, date | Study addressed a clearly focused issue | Use of an appropriate method / Randomisation (for RCTs) | Recruitment / comparability of study groups at baseline | Blinding (for RCTs) | Exposure measurement | Outcome measurement | Comparability of study groups during study (for RCTs) | Follow up (for longitudinal studies) | Confounding factors (for non-RCTs) | Applicability to England | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Alageel and Wright, 2017 | High | Medium – cohort study | Medium – case and control groups were matched, but matching criteria weren't reported | NA | High | Medium – I assume that smoking prevalence was self-reported | NA | High | Medium/ can't tell | High | Medium |
| 6 | Chang et al. 2017 | High | Low - survey | Medium – lack of information re characteristics of comparison groups (e.g. the male sample could have been older and more prone to each health condition compared to the female group) | NA | High | Medium – lack of information re diagnosis of each condition of interest | NA | NA – this was a survey | Medium / can't tell – see 'recruitment/ comparability of study groups'<br><br>As gender and level of deprivation groups and were compared, these factors were controlled, however there was lack of control for multiple confounding | High | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | factors in each analysis | | |
| 2 | Coghill et al. 2016 | High | Medium – quasi experimental study | Medium – characteristics of comparison groups are presented, however there are no statistical comparisons to assess if the groups differ significantly on any characteristics | NA | High- standard approaches appear to have been used, with training provided to community workers who provided the telephone invites | High – attendance versus non-attendance and demographic characteristics, which I assume were accurately measured | NA | NA | Medium – age, gender, IMD but smoking and ethnicity were not controlled for | Low -data from Bristol | Low |
| 6 | Coghill et al. 2018 | High | Low- cross sectional | NA | NA | High- I would have thought it unlikely that demographic data were inaccurate | High - attendance or non-attendance at NHS Health Check | NA | NA – this was a survey | Medium – age, gender and IMD, but not ethnicity controlled for in adjusted models | Low – data from 38 GP practices, in Bristol. | Medium |
| 6 | Collins 2019 | Medium - not explicit | High | NA | NA | High | High | NA | NA | NA | Low – data from Liverpool | High |
| 6 | Collins 2017 | Medium - not explicit | High | NA | NA | High | High | NA | NA | NA | Low – data from Liverpool | High |
| 2 | Cornelius 2018 | Medium | High - RCT | Medium | Low – as unable to blind the format of the letter from participants | High – appears to have been standardised within groups | High (NHS health check uptake) | Medium (see ‘Recruitment / comparability of study groups at baseline’) | NA | NA | Low- data from 12 GP practices | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Gidlow 2019 | High | High – RCT | Medium - | Low – as unable to blind the format of the letter from participants | High | High | Medium (see 'Recruitment / comparability of study groups at baseline') | NA | NA | Low- practices from Stoke-on-Trent and Staffordshire | Low |
| 2 & 6 | Gulliford 2017 | High | Medium– cohort study | Medium | NA | High | High | NA | NA | High – ORs were adjusted for gender, age-group, ethnicity and IMD quintile | Low – study was conducted using data from two London boroughs | Medium |
| 6 | Hinde 2017 | High | High | NA | NA | High | High | NA | NA | NA | High | High |
| 1 | Chattopadhyay 2019 | High | Low- survey | NA | NA | High | High | NA | NA – this was a survey study | High- Multiple confounders were adjusted for in the multiple logistic regression models | Low-data from Leicester dataset | Medium |
| 6 | Kennedy 2019 | High | Medium- quasi RCT | Medium- variation in relation to age of attendees versus non-attendees, with attendees being older and therefore more likely to have the medical | NA | High | High | NA | NA | Medium as age and gender were controlled for in the analyses | Low – data from south England | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | conditions of interest | | | | | | | | |
| 2 | McDermott 2018 | Medium | High - RCT | High – age, ethnicity, gender and IMD appeared to be well balanced across groups | High | High | High | High | NA | NA | Low – 18 GP practices in two London boroughs | High |
| 6 | Mytton 2018 | High | High | NA | NA | High | High | NA | NA | NA | High | High |
| 6 | Palladino 2017 | High | Medium – quasi experimental study | Low -can't tell/ not reported | NA | High | High | NA | NA | Low – can't tell | High | Medium |
| 2 | Public Health England 2018 | High | High- RCT | Medium – age and sex were comparable across groups; lack of data were presented re the proportion of additional traits (e.g. ethnicity and deprivation level) across study groups | High | High | High | Medium | NA | NA | Low- practices from Lewisham and Lincolnshire | Medium |
| 6 | Robson 2017 | High | Medium – observational matched study | Medium – females were more likely than males to attend; there was also variation in attendance | NA | High | High | NA | NA | Medium – as females were more likely to attend, thus potentially reducing the perceived | Low – East London GP practices | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | according to ethnicity, however deprivation and age variations were approximately balanced between groups | | | | | | effectiveness of the programme for disease detection as males are more likely to have higher risk of CVD | | |
| 2 | Sallis 2019 | High | High - RCT | Medium- significant differences were found in relation to ethnicity in the SMS pre-notification comparison groups, and WRT sex between groups who received different letter types. Lack of significant difference re other key confounders. | High | High | High | Medium | NA | NA | Low – data from one London borough | Medium |
| 1 | Woringer 2017 | Medium | Low- cross sectional | Medium- No significant differences were found in relation to ethnicity between groups, | NA | High | High | Medium | NA | Medium | High | Low |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | High | | however there were sig difference in age, sex and deprivation level between attendees and the general population | | | | | | | | |
| 4 and 6 | Alageel & Gulliford (2019) | High | Medium | High | NA | High | High | NA | High | Medium | High | High |
| 6 | Chang et al. (2016b) | High | High | High | NA | Medium | High | NA | Medium | High | High | Medium |
| 2 | Gold et al. (2019) | High | Medium | Medium | High | High | High | Medium | NA | NA | Low | High |
| 1 and 6 | Lang et al. (2016) | High | Low | HNA | NA | Medium | High | NA | NA | Medium | Medium | Medium |
| 2 | Whittaker (2019) | High | Low | Low | NA | Medium | Medium | NA | NA | Low | Low | Low |

**Table 1. Objective 1: Are there differences in demographic factors of those attending and not attending an NHS Health Check?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 29 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | none | ⊕⊕◯◯ LOW | IMPORTANT |

a. One study had a quasi-experimental design, the others were observational studies of various designs.

b. A significant proportion of the studies were rated low for baseline imbalances between groups and lack of control for confounding, however the purpose of this question was to assess variations in NHS Health Check attendance versus non-attendance between population sub-groups in relation to social characteristics, therefore imbalances in characteristics between the intervention and control groups were expected and these are likely to reflect reality.

c. Overall the results indicate that older persons and females were most likely to attend an NHS Health check. The results were less consistent in relation to ethnicity. Results tended to vary according to the sample size and geographic coverage of each study. Studies also varied in relation to setting and the cardiovascular risk profile of participants, therefore inconsistencies were not unexplained.

d. The overall sample size is large.

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29. Lang SJ, Abel GA, Mant J, et al. Impact of socioeconomic deprivation on screening for cardiovascular disease risk in a primary prevention population: a cross-sectional study. *BMJ Open* 2016;6(3):e009984.

**Table 2. Objective 2.1: Do socio-demographic factors affect update of the NHS Health Check?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 12 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | none | ⨁⨁◯◯ LOW | IMPORTANT |

a. One study was a randomized controlled trial, one study had a quasi-randomized design; the remaining studies were non-randomized studies, mainly experimental.

b. Six (50%) of the studies received a 'low' rating for domains relevant to the risk of bias, however four of these the issues were in relation to baseline imbalances and confounding, however the purpose of this research objective is to identify sociodemographic differences between attendees and non-attendees. Only two of twelve studies received a low rating for domains relevant to the risk of bias (exposure and outcome measurement and blinding). However, in the context of the NHS Health Checks programme, where the intervention is obvious and data are routinely collected and subject to inaccuracies, these issues don't necessarily indicate poor quality research methods were used.

c. Generally, older persons, females and individuals from least deprived background were most likely to attend NHS Health Checks. The results in relation to ethnic group were mixed. Variations in results across studies are likely to reflect heterogeneity between studies, including different methods and geographical coverage.

d. The sample size overall, across the included studies was large.

**References:**

1. Attwood S, Morton K, Sutton S. Exploring equity in uptake of the NHS Health Check and a nested physical activity intervention trial. *Journal of public health (Oxford, England)* 2016;38(3):560-68.
2. Cochrane T, Gidlow CJ, Kumar J, et al. Cross-sectional review of the response and treatment uptake from the NHS Health Checks programme in Stoke on Trent. *Journal of public health* (Oxford, England) 2013;35(1):92-8.
3. Cook EJ, Sharp C, Randhawa G, et al. Who uses NHS health checks? Investigating the impact of ethnicity and gender and method of invitation on uptake of NHS health checks. *Int J Equity Health* 2016;15:13.
4. Dalton AR, Bottle A, Okoro C, et al. Uptake of the NHS Health Checks programme in a deprived, culturally diverse setting: cross-sectional study. Journal of public health (Oxford, England) 2011;33(3):422-9.
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6. Kumar J, Chambers R, Mawby Y, et al. Delivering more with less? Making the NHS Health Check work in financially hard times: real time learning from Stoke-on-Trent. *Qual Prim Care* 2011;19(3):193-9.
7. NHS Greenwich. Evaluation of NHS Health Checks and Community Outreach Programme in Greenwich. 2011:1-61.

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9. Coffee S. Engaging Mental Health Service Users in Solihull with the NHS Health Check Programme: A Community Pilot Project 2015
10. Coghill N, Garside L, Chappell A. A Quantitative Quasi-experimental Approach to the Evaluation of a Telephone Outreach Service. University of Bath 2016
11. Hooper J, Chohan P, Caley M. Case detection of disease by NHS Health Checks in Warwickshire, England and comparison with predicted performance. *Public Health* 2014;128(5):475-7.
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**Table 3. Objective 2.2: Do variations to the invitation method affect NHS Health Check attendance? Assessment of quantitative evidence**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 13 | observational studies[a] | serious[b] | not serious[c] | not serious | not serious[d] | None | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. 6 RCTs; N=2 quasi-randomized trials; the remaining studies used observational designs.

b. Most (>50%) of studies scored low for one or more domain that could introduce bias into the study results.

c. The standard national invitation letter was generally associated with reduced uptake compared to variations. The variations differed between studies, therefore differences in relative uptake between groups in each study are expected.

d. The sample size was large (in the thousands) across studies.

**References:**


1. Cook EJ, Sharp C, Randhawa G, et al. Who uses NHS health checks? Investigating the impact of ethnicity and gender and method of invitation on uptake of NHS health checks. *Int J Equity Health* 2016;15:13.
2. Kumar J, Chambers R, Mawby Y, et al. Delivering more with less? Making the NHS Health Check work in financially hard times: real time learning from Stoke-on-Trent. *Qual Prim Care* 2011;19(3):193-9.
3. McDermott L, Cornelius V, Wright AJ, et al. Enhanced Invitations Using the Question-Behavior Effect and Financial Incentives to Promote Health Check Uptake in Primary Care. *Ann Behav Med* 2018;52(7):594-605.
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6. Cornelius VR, McDermott L, Forster AS, et al. Automated recruitment and randomisation for an efficient randomised controlled trial in primary care. *Trials* 2018;19(1):341.
7. Gold N, Durlik C, Sanders JG, et al. Applying behavioural science to increase uptake of the NHS Health Check: a randomised controlled trial of gain- and loss-framed messaging in the national patient information leaflet. *BMC Public Health* 2019;19(1):1519.

8. Gulliford MC, Khoshaba B, McDermott L, et al. Cardiovascular risk at health checks performed opportunistically or following an invitation letter. Cohort study. *Journal of public health (Oxford, England)* 2018;40(2):e151-e56.
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10. McDermott L, Wright A, Cornelius V. Enhanced invitation methods and uptake of health checks in primary care. Rapid randomised controlled trial using electronic health records. *Health Technology Assessment* 2017;20(84)
11. Alpsten BT. Saving lives through effective patient engagement around NHS health checks. *Clin Gov* 2015;20:108-12.
12. Local Government Association. Checking the health of the nation : Implementing the NHS Health Check Programme studies - Stoke-on-Trent. 2015
13. Gidlow CJ, Ellis NJ, Riley V, et al. Randomised controlled trial comparing uptake of NHS Health Check in response to standard letters, risk-personalised letters and telephone invitations. *BMC Public Health* 2019;19(1):224.

**Table 4. Objective 2.2 Do variations to the invitation method affect NHS Health Check attendance? Assessment of qualitative evidence**

| Finding | Studies contributing to findings (see report reference list) | Methodological limitations | Coherence | Adequacy | Relevance | CERQual assessment of confidence in the evidence | Explanation of CERQUAL assessment |
|---|---|---|---|---|---|---|---|
| Differing views on opportunistic recruitment depending on setting | Greenwich *et al* (2011) Ismail *et al* (2015) Perry *et al* (2014) Riley *et al* (2015) | Most papers were highly rated in terms of quality, with only one being rated overall as medium quality. Two papers scored low in ethical issue and one in rigour | There were no or few concerns identified in any of the papers as they all presented similar data to the findings presented in the review. | Three papers had minor concerns due to not presenting a rich picture of the data gathered. The other had no or few minor concerns | One of the papers had moderate concerns as the quote presented in the review was not clearly linked to the theme and the paper did not otherwise refer to this theme.[51] | Moderate confidence | Reduced grade due to moderate concern and minor concerns around ethical issues and richness of data |
| Benefit of community ambassadors, particularly for ethnic minority groups | Riley *et al* (2015) Stone *et al* (2019) | One paper was medium and one high rated, both scored lower in their description of the relationship between researcher and participants. | There were no or few concerns identified in either paper in this domain. | No or few minor concerns | No or few minor concerns in either paper | High confidence | No reason to downgrade |
| Preference for telephone contact | Stone *et al* (2019) Strutt *et al* (2011) Greenwich *et al* (2011) | Greenwich and Stone medium quality overall, Strutt high quality overall | No coherence concerns | Moderate concern due to richness of data gathered | No concerns | Moderate confidence | Reduced grade due to concerns on richness of data |

**Table 5. Objective 2.3 Does GP practice versus alternative setting affect NHS Health Check uptake?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 2 | observational studies | serious [a] | not serious [b] | not serious | not serious [c] | none | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. Both studies scored low for imbalances in baseline characteristics between groups and confounding.

b. One study reported higher uptake in GP surgeries whereas the other reported similar attendance between settings. This variation is likely to reflect heterogeneity between studies in relation to the population, mode of invitation and the type of non-GP setting in which the NHS Health Checks were performed.

c. Overall sample size across the two studies was large (in the thousands)

**References:**

1. Roberts DJ, de Souza VC. A venue-based analysis of the reach of a targeted outreach service to deliver opportunistic community NHS Health Checks to 'hard-to-reach' groups. *Public Health* 2016;137:176-81.
2. Whittaker PJ. Uptake of cardiovascular health checks in community pharmacy versus general practice. *Journal of Fluid Mechanics* 2020;884:6.

**Table 6. Objective 4 Support for the concept of management of people identified as being at risk of CVD, as an outcome of the NHS Health Checks intervention Assessment of mixed methods evidence.**

| Domain | Assessment of support | Level of support |
|---|---|---|
| Truth value/bias | Inferences and conclusions were reflected in the quantitative and qualitative data. | Moderate |
| Explanation credibility | The issues raised by health professionals were sound. There was a lack of exploration of the reasons why service delivery/ implementation/ follow up, between practices. | Moderate |
| Weakness minimisation | Data in relation to this concept were collected from quantitative, qualitative and mixed methods although the study designs were homogeneous (quant data collected from cross-sectional surveys; qualitative data collected from free text responses and semi-structured interviews). Consistencies were apparent across different study types in relation to variations in service delivery, referrals and follow ups. | Strong |
| Inside-outside | Quantitative and qualitative data were collected, however interview and survey methods may entail responder and reporting biases. Objectivity of these methods is therefore limited. | Low |
| Publication bias | Lack of significance testing therefore it is not possible to assess for this criterion | n/a |
| Additional comments | None | n/a |
| Overall assessment | Moderate | |

**References:**


1. Baker C, Loughren EA, Crone D, et al. A process evaluation of the NHS Health Check care pathway in a primary care setting. Journal of public health (Oxford, England) 2015;37(2):202-9.
2. Greenwich N. Evaluation of NHS Health Checks and Community Outreach Programme in Greenwich. 2011:1-61.
3. McDermott L, Cornelius V, Wright AJ, et al. Enhanced Invitations Using the Question-Behavior Effect and Financial Incentives to Promote Health Check Uptake in Primary Care. Ann Behav Med 2018;52(7):594-605.
4. Ismail H, Atkin K. The NHS Health Check programme: insights from a qualitative study of patients. Health Expect 2016;19(2):345-55.
5. Riley R, Coghill N, Montgomery A, et al. The provision of NHS health checks in a community setting: an ethnographic account. BMC health services research 2015;15:546. doi: 10.1186/s12913-015-1209-1
6. Alageel S, Gulliford MC. Health checks and cardiovascular risk factor values over six years' follow-up: Matched cohort study using electronic health records in England. PLoS Med 2019;16(7):e1002863.
7. Alageel S, Gulliford MC, McDermott L, et al. Implementing multiple health behaviour change interventions for cardiovascular risk reduction in primary care: a qualitative study. BMC Fam Pract 2018;19(1):171.
8. Alageel S, Gulliford MC, Wright A, et al. Engagement with advice to reduce cardiovascular risk following a health check programme: A qualitative study. Health Expect 2020;23(1):193-201.
9. 69. Ismail H, Kelly S. Lessons learned from England's Health Checks Programme: using qualitative research to identify and share best practice. BMC Fam Pract 2015;16:144.
10. Nicholas JM, Burgess C, Dodhia H. Variations in the organization and delivery of the 'NHS Health Check' in primary care. J Public Heal 2013;35:85-91.
11. Oswald N, Mcnaughton R, Watson P. Tees Vascular Assessment Programme Evaluation. 2010
12. McNaughton RJ, Oswald NT, Shucksmith JS, et al. Making a success of providing NHS Health Checks in community pharmacies across the Tees Valley: a qualitative study. BMC health services research 2011;11:222.
13. Research Works. Public Health England Understanding the implementation of NHS Health Checks. 2013
14. Riley R, Coghill N, Montgomery A, et al. Experiences of patients and healthcare professionals of NHS cardiovascular health checks: a qualitative study. Journal of public health (Oxford, England) 2016;38(3):543-51.
15. Shaw RL, Pattison HM, Holland C. Be SMART: examining the experience of implementing the NHS Health Check in UK primary care. BMC Fam Pract 2015;16:1.
16. Shaw RL, Lowe H, Holland C, et al. GPs' perspectives on managing the NHS Health Check in primary care: a qualitative evaluation of implementation in one area of England. BMJ Open 2016;6(7):e010951.
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18. Crabtree V, Hall J, Gandecha M. NHS Health Checks: The views of community pharmacists and support staff. Int J Pharm Pract 2010 2010;18:35-6.
19. Graley CEM, May KF, DC. M. Postcode lotteries in public health - the NHS Health Checks Programme in North West London. BMC Public Health 2011;11:738.
20. Krska J, du Plessis R, Chellaswamy H. Views of practice managers and general practitioners on implementing NHS Health Checks. Prim Health Care Res Dev 2016;17(2):198-205.
21. Loo RL, Diaper C, Salami OT. The NHS Health Check: The views of community pharmacists. Int J Pharm Pract 2011;19:13.

**Table 7. Objective 5 Support for the concept of patient experiences as an outcome of the NHS Health Checks intervention Assessment of mixed methods evidence.**

| Domain | Assessment of support | Level of support |
|---|---|---|
| **Truth value/bias** | Inferences and conclusions made by authors were reflected in the quantitative and qualitative data reported. For example, high levels of satisfaction were evident in the results from quantitative survey data, and participant quotes supported the themes derived by authors.<br>The quantitative data presented from satisfaction surveys were based on questions that were perhaps too broad in focusing on general, overall satisfaction. However, the negative aspects of patients' experiences were captured in the qualitative data.<br>It would have been helpful if the studies which used mixed methods had collected numeric data based on the results from the qualitative methods. For example, by quantifying the number/ proportion of patients who issues expressed through the qualitative data (e.g. how many understood their risk score) | Moderate |
| **Explanation credibility** | The issues regarding patient experiences of the NHS Health Checks programme that were reflected in quotes are understandable (e.g. patient expectations that a 'Health Check' would entail testing for medical conditions not just affecting the cardiovascular system; lack understanding of the risk score). Some studies lacked exploration of the social and psychological mechanisms relating to the issues that patients experienced. For example, the reasons why many attendees would struggle to interpret the risk score. | Moderate |
| **Weakness minimisation** | Supported across limited quantitative (cross-sectional surveys) and several qualitative designs (free-text survey responses; focus groups and interviews). The quantitative data indicate a high level of patient satisfaction, whereas the data from qualitative studies highlight issues with the NHS Health Checks Programme | Inconsistent support |
| **Inside-outside** | The data covers views and quantitative responses from patients. These methods are all at risk of responder bias and may represent the views of those with particularly strong opinions. Objectivity of these methods is therefore limited. | Low |
| **Publication bias** | Lack of significance testing therefore it is not possible to assess for this criterion | n/a |

| | | |
|---|---|---|
| **Additional comments** | None | n/a |
| **Overall assessment** | Low/moderate | |


**References**

1. Corlett SA, Krska J. Evaluation of NHS Health Checks provided by community pharmacies. Journal of public health (Oxford, England) 2016;38(4):e516-e23.
2. Greenwich N. Evaluation of NHS Health Checks and Community Outreach Programme in Greenwich. 2011:1-61.
3. Trivedy C, Vlaev I, Seymour R, et al. An evaluation of opportunistic health checks at cricket matches: the Boundaries for Life initiative. Sport in Society 2017;20(2):226-34.
4. Krska J, du Plessis R, Chellaswamy H. Views and experiences of the NHS Health Check provided by general medical practices: cross-sectional survey in high-risk patients. Journal of public health (Oxford, England) 2015;37(2):210-7.
5. Ismail H, Atkin K. The NHS Health Check programme: insights from a qualitative study of patients. Health Expect 2016;19(2):345-55.
6. Perry C, Thurston M, Alford S. The NHS health check programme in England: a qualitative study. Health Promot Int 2014;31:106-15.
7. Riley R, Coghill N, Montgomery A, et al. The provision of NHS health checks in a community setting: an ethnographic account. BMC health services research 2015;15:546.
8. Strutt E. Patient-centred care: patients' experiences of and responses to the National Health Service (NHS) Health Check programme in general practice. PLoS Med 2019;16(7):e1002863.
9. Alageel S, Gulliford MC, McDermott L, et al. Implementing multiple health behaviour change interventions for cardiovascular risk reduction in primary care: a qualitative study. BMC Fam Pract 2018;19(1):171.
10. Alageel S, Gulliford MC, Wright A, et al. Engagement with advice to reduce cardiovascular risk following a health check programme: A qualitative study. Health Expect 2020;23(1):193-201.
11. Baker C, Loughren EA, Crone D, et al. Patients' perceptions of a NHS Health Check in the primary care setting. Qual Prim Care 2014;22(5):232-7.
12. Oswald N, Mcnaughton R, Watson P. Tees Vascular Assessment Programme Evaluation. 2010
13. Alford S, Catherine P. Knowsley at Heart community NHS health checks: Behaviour change evaluation. 2010
14. Chipchase L, Hill P, Waterall J. An insight into the NHS Health Check Programme in Birmingham; Summar report. 2011
15. Jenkinson CE, Asprey A, Clark CE, et al. Patients' willingness to attend the NHS cardiovascular health checks in primary care: a qualitative interview study. BMC Fam Pract 2015;16:33.
16. Research Works. Public Health England Understanding the implementation of NHS Health Checks. 2013
17. Riley R, Coghill N, Montgomery A, et al. Experiences of patients and healthcare professionals of NHS cardiovascular health checks: a qualitative study. Journal of public health (Oxford, England) 2016;38(3):543-51.

18. Hawking MKD, Timmis A, Wilkins F, et al. Improving cardiovascular disease risk communication in NHS Health Checks: a qualitative study. BMJ Open 2019;9(8):e026058.
19. Alageel S, Gulliford MC. Effect of the NHS Health Check programme on cardiovascular disease risk factors during 6 years' follow-up: matched cohort study. Lancet 2018;392:17-17.
20. Cowper. The NHS Health Check Leadership Forum : Summary and Findings. NHS Heal Check Leadersh Forum 2013. NHS Heal Check Leadersh Forum 2013
21. Riding L-E. Public health transformation twenty months on: adding value to tackle local health needs. http://wwwlocalgovuk/documents/10180/6869714/L15_15+Public+health+transformation+twenty+months+on_WEB_39693pdf/7bb8060e-9a7b-4b85-8099e854be74cfb5 2015
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23. McNaughton RJ, Shucksmith J. Reasons for (non)compliance with intervention following identification of 'high-risk' status in the NHS Health Check programme. Journal of public health (Oxford, England) 2015;37(2):218-25.
24. Shaw RL, Pattison HM, Holland C, et al. Be SMART: examining the experience of implementing the NHS Health Check in UK primary care. BMC Fam Pract 2015;16:1.

**Table 8 Objective 6.1** Are disease detection rates higher for GP practices in areas with high versus low population coverage of the NHS Health Check programme?

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 3 | observational studies[a] | not serious | not serious[b] | serious[c] | not serious[d] | none | ⨁◯◯◯ VERY LOW | CRITICAL |

a. Study descriptions were: quasi-experimental study; non-randomised controlled study and an observational study

b. Palladino (2017) found that high NHS Health Checks program coverage was associated with increased detection of diabetes whereas Lambert (2015) found that increased population coverage of the NHS Health Checks programme was not associated with growth in GP practice disease registers for diabetes. Caley (2014) found no significant associations between % eligible completing an NHS Health Check and change in prevalence of five conditions including diabetes. These variations could reflect ecological effects, attributable to differences in the geographical coverage of each study.

c. The nature of the intervention group varied between studies. For example, Palladino (2017) compared GP practices with high versus medium or low coverage; Lambert (2016) assessed variation in detection rates in relation to number of health checks performed across practices (therefore no binary intervention and control groups) and Calley (2014) compared practices that offered the intervention with control practices which did not.

d. One of the studies (Palladino 2017) used data from a large sample and the confidence intervals did not cross the line of no effect.

<u>**References**</u>


1. Palladino R, Vamos E, Chang KCM, et al. Impact of a national diabetes risk assessment and screening programme in England: a quasi-experimental study. Lancet 2017;390:S65-S65.
2. Caley M, Chohan P, Hooper J, et al. The impact of NHS Health Checks on the prevalence of disease in general practices: a controlled study. *Br J Gen Pract* 2014;64(625):e516-21.
3. Lambert MF. Assessing potential local routine monitoring indicators of reach for the NHS health checks programme. *Public Health* 2016;131:92-8.

**Table 9 Objective 6.1 Are disease detection rates higher amongst those attending an NHS Health Check following an opportunistic versus standard invitation?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 1 | observational studies | not serious[a] | [b] | not serious | serious[c] | none | - | CRITICAL |

a. The study received one low overall rating, however this was in relation to the external rather than internal validity of the study.
b. Not applicable as only one study is included in this GRADE assessment.
c. The sample size was relatively small and the confidence intervals quite wide for >10% CVD risk in this study.

**References**

Gulliford MC, Khoshaba B, McDermott L, et al. Cardiovascular risk at health checks performed opportunistically or following an invitation letter. Cohort study. Journal of public health (Oxford, England) 2018;40(2):e151-e56.

**Table 10 Objective 6.1 Are disease detection rates higher amongst those attending an NHS Health Check versus those who do not attend?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 4 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | strong association[e] | ⨁⨁⨁◯ MODERATE | CRITICAL[f] |

a. One study had a quasi-experimental design, three were cohort studies.
b. None of the studies received low ratings for domains relevant to internal validity/ risk of bias.
c. Overall, the intervention was associated with increased disease detection. Rates for individual diagnoses varied across studies however this is likely to reflect differences between samples, as some studies used national data whereas others used data from regions or smaller spatial units.
d. Some of the studies were small and potentially under powered, however several studies used national data sets and therefore the overall sample size is large. Confidence intervals crossed the line of no effect in some cases however generally, confidence intervals were not large.
e. Robson (2017) reported the rate of chronic kidney disease diagnosis amongst attendees as 83%.
f. The purpose of the NHS Health Checks program is to screen for chronic health conditions.

**References**


1. Kennedy O, Su F, Pears R, Walmsley E, Roderick P. Evaluating the effectiveness of the NHS Health Check programme in South England: a quasi-randomised controlled trial. BMJ Open. 2019 Sep 20;9(9):e029420.
2. Robson J, Dostal I, Madurasinghe V, Sheikh A, Hull S, Boomla K, et al. NHS Health Check comorbidity and management: an observational matched study in primary care. Br J Gen Pract. 2017 Feb;67(655):e86-e93.
3. Chang KCM, Lee JT, Vamos EP, Soljak M, Johnston D, Khunti K, et al. Impact of the National Health Service Health Check on cardiovascular disease risk: a difference-in-differences matching analysis. Canadian Medical Association Journal. Jul;188(10):E228-E38.
4. Forster AS, Dodhia H, Booth H, et al. Estimating the yield of NHS Health Checks in England: A population-based cohort study. J Public Heal (United Kingdom) 2015;37:234–40.

**Table 11 Objective 6.2 Does NHS Health Check attendance versus non-attendance influence health-related behaviour (smoking status/ prevalence)?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 5 | observational studies[a] | serious[b] | serious[c] | not serious | Not estimable[d] | none | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. One randomised study and four observational studies.

b. Mode of collection of smoking data wasn't consistently reported, however it is likely to have been self-report and entered into routine medical records which relies on patients both attending the general practice and being asked about their smoking status within that time. Issues associated with self-report data and completeness could introduce biases in relation to the outcome measurement.

c. Although point estimates indicated a reduction in smoking across studies, there were inconsistencies regarding the statistical significance of these effects between studies.

d. Imprecision is not estimable due to differences in effect calculations between studies.

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**References**

1. Chang KC, Lee JT, Vamos EP, et al. Impact of the National Health Service Health Check on cardiovascular disease risk: a difference-in-differences matching analysis. *CMAJ* 2016;188(10):E228-E38.
2. Forster AS, Dodhia H, Booth H, et al. Estimating the yield of NHS Health Checks in England: a population-based cohort study. *Journal of public health (Oxford, England)* 2015;37(2):234-40.
3. Alageel S, Gulliford MC. Health checks and cardiovascular risk factor values over six years' follow-up: Matched cohort study using electronic health records in England. *PLoS Med* 2019;16(7):e1002863.
4. Cochrane T, Davey R, Iqbal Z, et al. NHS health checks through general practice: randomised trial of population cardiovascular risk reduction. *BMC Public Health* 2012;12(1):944.
5. Artac M, Dalton AR, Majeed A, Car J, Huckvale K, Millett C. Uptake of the NHS Health Check programme in an urban setting. Family practice. 2013 Aug 1;30(4):426-35.

**Table 12 Objective 6.3 What proportions of NHS Health check attendees receive risk management advice or referrals?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 11 | observational studies[a] | serious [b] | serious[c] | not serious | not serious[d] | none | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. One quasi-randomised controlled trial(Kennedy *et al* 2019)[97]; the remaining studies had an observational design.

b. Two studies (Krska *et al* 2015[23] and Baker *et al* 2015[17]) were rated low on confounding; one study (Foster 2015[13]) was rated low on outcome measurement. These are issues relevant to the internal validity of a study.

c. Large variations existed in the proportions of patients being referred to lifestyle services between studies. This heterogeneity is likely reflective of geographical variations in referrals.

d. The eleven studies which reported relevant data to address the research question were mixed in their coverage; some used national datasets with large sample sizes other studies used regional data. Overall however, the sample size was large. Confidence intervals were not presented for several studies and it is likely that the confidence intervals were large for the regional studies, however in several of the larger studies for which CIs were presented, these were narrow.

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**Table 13 Objective 6.4 Does the NHS Health Check versus no NHS Health Check reduce cardiovascular disease risk?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 5[a] | observational studies[b] | serious[c] | not serious[d] | not serious | not serious[e] | none | ⨁◯◯◯ VERY LOW | CRITICAL |

a. One study was a randomized trial, the other four were observational studies.
b. One study had a domain with a low rating - Forster (2015), for outcome measurement. This could affect the internal validity for assessment of the association between NHS Health Checks and CVD risk. Although the other four studies studies were rated as medium or high for this domain, the study by Forster (2015) was the largest study in the analysis and could have impacted significantly on the overall results.
c. Results were generally consistent across studies
d. Decision based on confidence intervals which were reasonably narrow and did not cross the line of no effect. Also, only one of the studies did not use a national data set with a large sample size.
e. Decision based on confidence intervals which were reasonably narrow and die not cross the line of no effect. Also, three of the studies used national data sets with a large sample size.

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**Table 14. Objective 6.5 Does the NHS Health Check versus no NHS Health Check increase prescribing of statins or antihypertensive medication?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 16 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | none | ⨁⨁◯◯ LOW | IMPORTANT |

a. One study was a randomised trial, the remaining 15 had an observational design

b. The only study that received a low rating for a domain relevant to risk of bias was Krska 2016 which scored low for confounding. As other studies scored medium or high on this domain, it was deemed that risk of bias overall wouldn't be significantly affected.

c. Most studies show an increase in prescribing following the NHS Health Check. The exception is Alageel 2019 in relation to prescribing of anti-hypertensive medication.

d. Although variations in effect estimates are present between studies, this heterogeneity may be attributable to factors including different sample sizes and differences in study designs. The confidence intervals reported appear reasonably small and do not cross the line of no effect.


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BMJ Open

# NHS Health Check programme: A rapid review update.

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# NHS Health Check programme: A rapid review update.

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## Abstract

**Objective:** To update a rapid review published in 2017, which evaluated the NHS Health Check Programme.

**Methods:** An enlarged body of evidence was used to re-address six research objectives from a rapid review published in 2017, relating to the uptake, patient experiences and effectiveness of the NHS Health Check Programme. Data sources included Medline, PubMed, Embase, Health Management Information Consortium (HMIC), Cumulative Index of Nursing and Allied Health Literature (CINAHL), Global Health, PsycInfo, the Cochrane Library, NHS Evidence, Google Scholar, Google, Clinical Trials.gov and the ISRCTN registry, Web of Science, Science Citation Index, The Cochrane Library, NHS Evidence, Open Grey and hand searching article reference lists. These searches identified records from between January 1996 and December 2019. Screening, data extraction and quality appraisal using the Critical Appraisals Skills Programme checklists were performed in duplicate. Grading of Recommendations, Assessment, Development and Evaluations was implemented. Data were synthesised narratively.

**Results:** 697 studies were identified, and 29 new studies included in the review update. The number of published studies on the uptake, patient experiences and effectiveness of the NHS Health Check Programme has increased by 43% since the rapid review published in 2017. However, findings from the original review remain largely unchanged. NHS Health Checks led to an overall increase in the detection of raised risk factors and morbidities including diabetes mellitus, hypertension, raised blood pressure, cholesterol and chronic kidney disease. Individuals most likely to attend the NHS Health Check Programme included females, persons aged ≥60 years and those from more socioeconomically advantaged backgrounds. Opportunistic invitations increased uptake amongst males, younger persons and those with a higher deprivation level.

**Conclusions:** Although results are inconsistent between studies, the NHS Health Check programme is associated with increased detection of heightened CVD risk factors and diagnoses. Uptake varied between population subgroups. Opportunistic invitations may increase uptake.

## Strengths and limitations of this study

- This review summarises newly identified evidence, from January 1996 to December 2019, evaluating the NHS Health Check (NHS-HC) Programme, building on an earlier rapid review published in 2017.
- The methods involved searches of published and grey literature sources, duplicate blinded screening, data extraction and quality appraisal and assessment of the quality of the overall body of evidence for each objective.
- Meta-analysis was not feasible due to the heterogeneous nature of the included studies.
- The results indicate that the NHS-HC programme increases the detection of individuals at risk of cardiovascular disease and that inequalities exist in NHS-HC attendance between population sub-groups. Opportunistic invitations could increase uptake amongst these under-represented demographic groups.
- The overall body of evidence addressing the review objectives were 'very low' to 'moderate' quality therefore caution should be used when interpreting findings.

## Introduction

The NHS Health Check (NHS-HC) Programme is a cardiovascular disease (CVD) prevention programme introduced in 2009 aiming to assess all adults in England aged between 40 and 70 years old for CVD risk factors including obesity, physical inactivity, smoking and high alcohol consumption, high blood pressure and high cholesterol. Following assessment, using established tools, the level of individual risk is communicated to patients and evidence-based risk reduction interventions are implemented where appropriate.[1 2]

An important aspect of the NHS-HC is the long-term goal of reducing inequalities in premature deaths from cardiovascular disease, although the how was not explicitly stated.[3] An observational study which used records from 9.5 million patients reported that NHS-HC attendees were more likely to be older and women, but were similar in terms of ethnicity and deprivation, compared with non-attendees.[4] To address NHS-HC provider concerns [5] regarding equity of access and to achieve the aim of reducing inequalities in premature CVD deaths, potential discrepancies in equity of access and outcomes must be identified and addressed.

Cost-effectiveness of the NHS-HC has been a focal point for discussion. Original modelling estimated the programme could prevent 1,600 heart attacks and strokes, at least 650 premature deaths, and over 4,000 new cases of diabetes each year, with an estimated cost per quality adjusted life year (QALY) of approximately £3,000.[6] Since then, it has been suggested that the programme is wasting large amounts of money (~£450million).[7] However, some evidence suggests the checks may be cost-effective, with small changes in BMI equating to a small but positive QALY gain of 0.05 per participant (cost-effectiveness ratio of £900/QALY).[8] Additionally, such programmes could potentially be cost saving in the future if they correctly identify large numbers of people with CVD risk.[9]

Given these challenges it is important to consistently update and review available evidence to assess the impact of NHS-HC and the extent to which it is meeting the goal of addressing health inequalities. Additionally, a review of the NHS-HC programme was announced in the Government's prevention green paper[10] and this evidence review was undertaken with the intention of informing that review and potential changes to policy. We therefore aimed to update a previously completed rapid synthesis of published research evidence on the NHS-HC Programme, which incorporates evidence from studies published up to 9th November 2016.[1] The main findings of this earlier review included that NHS-HCs are associated with small increases in disease detection. Higher attendance (number of attendees as a function of those who are eligible) was found among older people, women, the most deprived populations (which may reflect targeting), and non-smokers. Take-up (number of attendees as a function of those who are invited) of an NHS-HC varied between population sub-groups, with older persons, women in younger age groups, men in older age groups, and people from the least deprived areas were more likely to attend. People did not take up the offer of an NHS-HC due to factors including lack of awareness of the service, competing priorities and difficulty with getting a GP appointment. Of those who attended NHS-HC, satisfaction levels were high. Methods which could increase uptake are invitation modifications and text message invitations or reminders. Health professionals expressed concerns regarding inequalities in uptake of the programme and the clinical and cost-effectiveness of NHS-HC.

The rapid review reported here aimed to update the aforementioned review, using the same objectives (as stated below).

## Objectives

Our aim was to update an earlier rapid review[1] and summarise newly identified evidence addressing the following research objectives:

1. Who is and who is not having an NHS Health Check (NHS-HC)?
2. What are the factors that increase take-up among the population and sub-groups?
3. Why do people not take up an offer of an NHS-HC?
4. How is primary care managing people identified as being at risk of cardiovascular disease or with abnormal risk factor results?
5. What are patients' experiences of having an NHS-HC?
6. What is the effect of the NHS-HC on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and on statin and anti-hypertensive prescribing?

## Methods

A rapid review update reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A checklist of PRISMA items is presented in the online supplementary file S1.[11]

## Patient and public involvement

No patients involved.

## Literature searches

The following databases were searched, from January 1996 to November 2016 in the earlier review[1] and from Jan 2016 to Dec 2019 for this update: Medline, PubMed, Embase, Health Management Information Consortium (HMIC), Cumulative Index of Nursing and Allied Health Literature (CINAHL), Global Health, PsycInfo, the Cochrane Library, NHS Evidence, Google Scholar, Google, Clinical Trials.gov and the ISRCTN registry, Web of Science, Science Citation Index and OpenGrey. Hand searching of key article reference lists was also completed. The search strategy is available in the online supplementary file S2.

## Study selection

Studies from the earlier review[1] were included in the review update. The studies from updated searches were split into batches and each record was independently reviewed by two authors (either RPWK, LMT or LMT, FP) based on title, abstract and full text using pre-specified inclusion and exclusion criteria (available in the online supplementary file S3) to identify those eligible for inclusion in the update. Conflicts were resolved through discussion, with adjudication by a third reviewer (either FP or RBG depending on who had not previously reviewed the record) where necessary.

## Data extraction

A random sample of 10% of the data extraction completed in the original review [1] was checked by LT and found to be consistent with information reported in the primary studies. Data from newly identified studies were extracted onto pre-specified, piloted, data pro-formas. Data from each quantitative study was extracted by a single reviewer (either RPWK or LT). Extracted data were then checked for accuracy by a different reviewer (either RPWK or LT). Any conflicts were resolved through discussion or via adjudication by a third reviewer (FP) when necessary. Pertinent qualitative data including direct participant quotes, researcher interpretations and concepts were extracted in duplicate (by MS and FP) with discrepancies discussed and resolved. Data were coded against the themes previously identified.[1] Emergent themes not previously identified were discussed and coded (by MS and FP). Duplicate extraction was completed for each qualitative paper by two reviewers from differing standpoints so as not to subconsciously affect the data being extracted and synthesised.

## Quality appraisal

The quality of newly identified studies was assessed by a single reviewer then verified by a second. Any discrepancies were resolved through discussion and, where required, adjudicated by a third reviewer. Qualitative studies were assessed by MS or FP using The Critical Appraisal Skills Programme (CASP) checklist for qualitative research.[12] Quantitative studies were assessed by RPWK or LT using a tool that was developed using CASP tools[12] and implemented by the previous review authors[1] to accommodate the range of study designs included.

## Data synthesis

Synthesis of new quantitative and qualitative data was completed as an extension to that undertaken in the original review. Numerical data were combined using a structured, narrative synthesis. Meta-analysis was not methodologically appropriate due to high heterogeneity and a low number of high-quality studies reporting on each objective in a consistent manner. For the qualitative data, a three-stage thematic synthesis approach[13] was planned in which newly identified studies could add to and potentially revise the original findings. This approach involves 'line-by-line' coding of the findings according to the content and meaning; developing 'descriptive themes' by grouping codes according to similarities and differences; generating 'analytical themes' based on the reviewer's interpretation of the data in relation to the research question.[13]

## Assessment of the certainty of the evidence

GRADE,[14] GRADE-CERQual[15] and a method for assessing certainty of evidence in mixed methods reviews[16] were used to assess the certainty and confidence in quantitative, qualitative and mixed methods evidence, respectively, contributing to each objective and sub-objective as appropriate.

## Results

The PRISMA flow diagram of included and excluded studies is shown in Figure 1. Twenty-nine newly identified studies were eligible for inclusion. The numbers of newly identified studies mapping to each research objective are as follows: objective 1 (n=6), objective 2 (n=9), objective 3 (n=0), objective 4 (n=4), objective 5 (n=2) and objective 6 (n=13). Quality appraisal scores for each study are shown in supplementary file S4. GRADE assessments are shown in supplementary file S5. The overall certainty of evidence ranged from 'very low' to 'moderate'. Results are also synthesised below in relation to each objective and sub-objective.



Please insert Figure 1 here

***Objective 1: Differences in demographics of those attending and not attending an NHS-HC***

NHS digital and Public Health England (PHE) published attendance data from 2012 to

2018.[17] The national average attendance was 44.2%, with variation across regions (range = 41.3-49.2%). The variation was greater at a local authority level where 2017-18 attendance varied from 19.5% to 75.8%. The original review identified 24 studies for this objective. This update identified 6 new studies.

Generally, more older adults (e.g. > 60 years old) attended than younger adults.[18-20] Evidence suggested males are less likely to attend than females,[17-19 21 22] as statistically evidenced in [21] (AOR: 0.75, 95% CI: 0.67-0.84) and [19] (AOR: 0.73, 95% CI: 0.67-0.8). Another study [20] however, provide some evidence that males may be more likely to attend than females when the NHS-HCs were conducted opportunistically, where health checks are offered to patients during face-to-face medical consultations for other reasons.

Attendance data regarding ethnic groups is inconclusive. The NHS Digital data[17] shows that over the time period of 2012-2018, those of an Asian or Black background had greater numbers of attendance than not attendance. Whilst those of a white British background had a greater number of non-attendees compared to attendees. However, this varied greatly by year with no single ethnic group consistently attending more often than not attending. [17 18] The authors of one study, [18] however, claim that white British had greater attendance at a national level but given that white British make up most of the eligible population this finding could be misleading. Attendance by ethnicity probably varies depending upon location. For example, community data from Leicester showed that people from Black and minority ethnic (BME) groups were more likely to attend than white people.[20] In terms of socio-economic status, there is some evidence those from a higher level of deprivation (identified by IMD) are less likely to attend an NHS-HC.[19 20] However, opportunistic NHS-HCs show an increase in attendance from those of a higher deprivation level.[22]

There is evidence to suggest lower levels of NHS-HC attendance among smokers.[20 21] One study [20] also reported the effect of religion on attendance, suggesting higher attendance of non-Christians than Christians. Those with no religious background were less likely to attend overall. This finding was from a single small community-based study and it is, therefore, difficult to make any inferences about the wider population.

The GRADE certainty in evidence rating for Objective 1 was ‘low’ due to the observational nature of study designs that contributed evidence.

***Objective 2: What factors increase take-up among population and sub-groups?***

Uptake has maintained a range of 45-50%, with recent national data from PHE reporting an uptake of 45.9% for 2018/2019.[23] There are, however, variations by region and constituency. For example, in the North East uptake varied between 25% and 61%.

*Objective 2.1 Socio-demographic determinants of uptake*

There were 11 quantitative studies included in the original review. We identify one new quantitative study conducted in two London boroughs (18 GP practices) reporting socio-demographic differences in uptake.[24] A randomised control trial (RCT) assessing uptake via standard invitation letter or a question behaviour effect (QBE) questionnaire (with/without financial incentive) followed by the invitation letter. Uptake across the three trial arms was 15.3%. This is significantly lower than previously reported (27% in [25]; 34.1% in [26] and 44.8% in [27]). One study [24] also found males and younger people less likely to attend an NHS-HC. Those with a non-white ethnic background were more likely to attend, however, this study area includes a large proportion of individuals from a non-white ethnic background and results may not be reflective of the wider population. Contradictory to Objective 1 findings, those from the second least deprived quintile were more likely to attend than those from the most deprived.

*Objective 2.2 Invitation methods*

Six new studies, adding to seven previously identified, assess the effects of different invitation methods, compared to the standard invitation letter, on uptake.[24 28-32] Use of the QBE questionnaire alone or with a financial incentive (£5) did increase uptake when it was returned. There were, however, no statistically significant changes in risk difference between the two invitation types (1.52%, 95% CI: -0.03 to 3.07%, $p$ = 0.054). This is lower than previous research estimating a 3-4% change.[33] One study compared the use of modified letters and telephone invitations.[30] While a different study compared a letter with yes/no SMS pre and post invitation.[32] Another study implemented new shorter leaflet styles (two vs four pages) but there were no statistically meaningful changes in uptake.[31] Use of SMS reminders and time limited letters did, increase uptake;[31] confirming the positive results previously reported in a similar study. [34] Telephone invitations also improved uptake compared to the standard letter invitation and a personalised CVD risk.[30] A cost analysis suggests that for every 1000 patients invited by telephone (compared to standard letters) an additional 180 NHS-HCs could be expected, with an extra cost of £0.24/patient. Telephone invitations are also strongly preferred by primary care and outreach workers.[35] Finally, the use of opportunistic invitations compared with the standard invitation letter improved uptake of those identified at greater CVD risk (i.e. risk score 10%).[29] Using opportunistic invitations also lead to an increase in younger patients attending.[22]

*Objective 2.3 Setting*

This update identified two quantitative studies which assessed the impact of setting on uptake rates; none were identified in the earlier review. These studies compared a GP setting to an outreach service[36] or community pharmacy.[37] One of the studies targeted hard-to-reach groups using opportunistic methods. While GP attendance was three times more than the outreach services, people of a South Asian ethnicity and higher IMD were more likely to attend the outreach services.[36] Males, however, were more likely to attend a GP than an outreach or community pharmacy service.[36 37] The other study found minimal differences in uptake of NHS-HCs after invitation by letter.[37] Opportunistic methods may provide greater uptake in some harder-to-reach patients.

The GRADE certainty in evidence ratings for Objectives 2.1-3 ranged from 'low' due to the observational nature of study designs to 'very low' due to high risk of bias ratings.

***Objective 3: Why do people not take up an offer of an NHS-HC?***

No new studies identified addressed this objective.

***Objective 4: How primary care is managing people identified as being at risk of CVD or with abnormal risk factor results***

The only study across both reviews to focus on risk management was [38]. They assessed CVD risk factors in England over a six-year follow-up period. An interrupted time series analysis (ITS) revealed mean Body Mass Index (BMI) following a health check was 0.3kg/m$^2$ (95% CI: 2-0.39kg/m$^2$) lower, while control patients' (no health check) BMI increased (0.08kg/m$^2$, 95% CI: 0.07-0.09kg/m$^2$ per year).[38] Additionally, after the six-year period, patients who had a health check were less likely to be smokers (AOR: 0.9, 95% CI: 0.87-0.94). NHS-HC attendees also had lower systolic and diastolic blood pressure, and lower total cholesterol.[38] High density lipoprotein was, however, slightly higher after six-years (0.01, 95% CI: 0.002-0.02). This single large study provides evidence that NHS-HCs can increase provision of risk management advice and interventions.

Fifteen qualitative studies were identified by the previous review, a further three are presented here. Three qualitative studies[35 39 40] investigated the views of those responsible for delivery of NHS-HCs. Healthcare professionals interviewed by [39] suggested that an NHS-HC was unlikely to be successful because people already knew the positive health behaviours they needed to engage with, but chose to ignore public health messaging. In a later study[40] it was found that GPs seemed more negative towards delivery of NHS-HCs than other staff. NHS-HCs were seen as time consuming or unclear in terms of outcome. Several GPs felt that it would be more efficient if health care assistants (HCAs) conducted the NHS-HC as the HCAs role is more focused on health promotion activities so they are more likely to have the opportunity and skills to elicit more personal information from patients. In contrast, HCAs were unsure if they had the right skills to undertake NHS-HCs, and indeed, whether this should be part of their role. One study found health professionals thought it was beneficial to have someone from a similar ethnic background invite a patient for an NHS-HC, as they understood how certain elements of the NHS-HC would relate to specific communities.[35] They also identified that employing outreach workers freed up GP and practice staff time to focus on other tasks. However, as outreach staff worked across multiple practices in the district, some practice managers were negative about the system as it meant they did not operationally manage them.

The certainty in evidence rating for Objective 4 was 'moderate'. Lack of objectivity was the main area of concern across studies addressing this objective.

***Objective 5: Patient views on NHS-HCs***

One study found patients felt a sense of obligation to attend and be "a willing patient", but family history affected how likely they were to make a change.[41] Some pointed to longevity in their family as a reason to avoid changing their health behaviours, others felt that as family members had high risk of CVD disease, it was inevitable they too would experience high risk, regardless of any behaviour change. In two studies by the same author [39 40] patients could not recall a specific risk score but did remember discussions around their current state of health. People felt more able to make changes when their family and friends supported and facilitated them to do so. Individuals valued being able to use their results from their NHS-HC to converse with their support networks identifying and introducing changes to their behaviours. Whilst one patient found the form filling and nature of the questioning to be off-putting,[41] the majority felt the experience of having a health check was positive.

The certainty in evidence rating for Objectives 5 was 'low' due to the subjective nature of participant data, to 'moderate'.

***Objective 6: Effects of the NHS-HC Programme on health outcomes***

Studies mapped to Objective 6 assessed the effects of the NHS-HC on one of the following predefined health outcomes: disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and statin and antihypertensive prescribing.

*Objective 6.1 Disease detection*

Seventeen studies reported data on disease detection, five of these were newly identified. One of the newly identified studies used data from 455 GP practices across England.[42] Incidence rates of detected non-diabetic hyperglycaemia and type 2 diabetes were significantly higher amongst individuals registered at GP surgeries with high NHS-HC coverage, compared to low coverage surgeries. Rates of non-diabetic hyperglycaemia were reported to be 19% higher in the high coverage compared to the low coverage group (Hazard Ratio (HR) 1·19, 95% confidence interval (CI) 1·01 to 1·41) and rates of type 2 diabetes were 10% higher (HR 1·11, 95% CI 1·03 to 1·19).[42]

Four studies used samples from smaller areas of England. One of the studies reported that individuals who received opportunistic NHS-HCs offered during patient encounters for other reasons, were significantly more likely to have a higher 10-year risk of CVD (CVD risk score ≥ 10%, assessed using the Joint British Societies' 'JBS3' risk calculator) compared to individuals who chose to attend following an invitation.[29] Two studies reported that NHS-HC attendance compared to non-attendance was associated with significant increase in detection or diagnosis of the following conditions: CVD risk > 10%;[43] diabetes and hypertension,[43 44] total cholesterol[43] and chronic kidney disease (CKD).[44] A different study compared disease detection rates between NHS-HC attendees from different socioeconomic groups and reported a significant increase in the detection of CVD risk > 20% amongst individuals from the most deprived IMD decile.[21]

*Objective 6.2 Health-related behaviours*

Five studies (one newly identified) reported data on health-related behaviours. The newly identified study used national (England) data from the Clinical Practice Research Datalink dataset. NHS-HC participants were less likely to be smokers compared to a control group after six years' follow-up (health check 17% versus controls 25%; odds ratio (OR) 0.90, CI

0.87 to 0.94, $p < 0.001$) however, a greater reduction in smoking prevalence was reported for the control group.[38]

*Objective 6.3 Risk management referrals*

Ten studies (four newly identified) reported data quantifying the proportion of NHS-HC attendees who were referred to lifestyle services. Two of the new studies used data from across England,[40 45] one study involved a sample of 151 general practices in Hampshire [43]and the other from 38 GP practices in Bristol.[19]

The proportions of NHS-HC attendees who were offered risk management advice or referrals varied between studies and in relation to the risk factor addressed, from 1.8-90% for smoking cessation interventions, < 1 % to 73% for weight management interventions among patients with a BMI of ≥ 30, and between 0.01%, and 33.9% for interventions to reduce alcohol consumption amongst patients who consumed ≥ 14 units per week. This is likely reflective of geographical variations in referrals between areas.

*Objective 6.4 CVD risk*

Five studies (one newly identified) assessed the change in CVD risk factor values following the NHS-HC. The newly identified study used national data from across England. Adjusted mean differences in 10-year CVD risk scores between intervention recipients and non-recipients at six years post-NHS-HC, were as follows: body mass index ($Kg/m^2$) -0.30 (95% CI -0.39 to -0.20, p<0.001); systolic blood pressure (mean, mm Hg) -1.43 (95% CI -1.70 to –1.16, p<0.001); diastolic blood pressure (mean, mm Hg) -0.93 (95% CI -1.11 to -0.75, p<0.001) total cholesterol (mean, mmol/L) – 0.05 (95% CI -0.07 to – 0.03, p<0.001), high density lipoprotein cholesterol (mean, mmol/L) 0.01 (95% CI 0.002 to 0.02, p>0.05).[38]

*Objective 6.5 Prescribing of statins and anti-hypertensives*

Sixteen studies (four newly identified) reported data on prescribing after the implementation of NHS-HC. One of the newly identified studies which used national data from across England reported that NHS-HC participants were more likely to receive statins (HR 1.24, 95% CI 1.21 to 1.27, $p < 0.001$) and were less likely to receive antihypertensive drugs (HR 0.86, 95% CI 0.85 to 0.88, $p < 0.001$) compared to non-attendees.[38] One study found that new statin prescriptions were higher for NHS-HC attendees compared to non-attendees.[44] The proportions of new statin prescriptions administered to NHS-HC attendees versus non-attendees were 11.5% and 8.2%, respectively. These data were from 143 general practices in three clinical commissioning groups (CCGs) in east London (England, UK). A different study also reported that NHS-HCs led to increased use of statins (OR 1.54, 95% CI 1.39 to 1.71) in addition to antihypertensives (OR 1.15, 95% CI 1.06 to 1.24) using data from 151 GP practices in Hampshire.[43] Another study compared prescribing rates between population sub-groups (male/female and age group) among NHS-HC attendees using data from GP practices in Bristol.[19] The results indicated that women were more likely than men to be prescribed a cardiovascular drug, (OR 1.18, 95% CI 1.03 to 1.35) as were patients aged ≥ 70 years compared to aged ≤70 years (OR 1.64, 95% CI 1.14 to 2.35). In the same study, individuals classified as being at high risk of CVD were most likely to be prescribed CVD medication (OR 6.16, 95% CI 4.51 to 8.40). There was no evidence of any association between the prescribing of CVD medication and socioeconomic status or ethnicity.

*Objective 6.6 Economic modelling studies*

Six studies (three newly identified) assessed the cost-effectiveness of the NHS-HC Programme based on different implementation approaches. Two of the new studies, which are related, assessed implementation and re-design scenarios using demographic data from Liverpool's population, exposure to risk factors and CVD epidemiology to assess health benefits, equity and cost effectiveness.[46 47] The third study assessed whether the impact of the checks on BMI was sufficient to justify its costs.[48] The two related studies reported that the equitability and cost-effectiveness of the NHS-HC Programme would be increased through the addition of policies targeting dietary consumption and through combining current provision with targeting of the intervention in deprived areas.[46 47] The third study reported that even modest changes in BMI from the NHS-HC Programme are associated with significant cost-saving benefits making the programme cost-effective.[48]

The GRADE certainty in evidence ratings for Objectives 6.1-5 ranged from 'very low' due to risk of bias, indirectness, imprecision and inconsistency, to 'moderate'.

## Discussion

The goal of the NHS-HC Programme is to identify and reduce CVD risk in those aged between 40 and 74 years. This rapid review aimed to update existing evidence on a previously completed review.[1]

*Principal findings*

The proportion of published studies has increased by 43% since the earlier review.[1] However, the majority of the key findings from the original review remain unchanged in this review update. The overall results from the earlier review and the review update are summarised as follows for each objective along with the findings from a body of relevant evidence identified prior to the publication of this review:

Objective 1 *Who is and who is not having an NHS-HC?* There is higher NHS-HC attendance among women and people aged 60 years and over. The association between female gender and NHS-HC attendance was confirmed by a newly identified study.[49] The evidence synthesised in this review indicated that smokers and those from high levels of deprivation are least likely to take up an invitation to attend an NHS Health Check, although a more recent study on over 9.5 million people reported no significant evidence of inequity of attendance by deprivation level.[4] There is mixed evidence regarding the association between ethnicity and NHS-HC attendance. Newly located studies report higher attendance among South Asian ethnic groups [49] and people with serious mental illnesses.[50]

Objective 2 *What are the factors that increase take-up among the population and sub-groups?* Opportunistic invitations, telephone invitations and text message reminders increased uptake compared to the standard invitation letters. Additionally, delivery setting influenced uptake in population subgroups, with people of a South Asian ethnicity and higher IMD more likely to attend the outreach services.(35) An RCT published in 2021 found that automated prompts to clinical staff to invite patients to NHS-HCs, delivered via computer systems in general practice, improved uptake, especially for men and younger patients.[51]

Objective 3 *Why do people not take up an offer of an NHS-HC?* The earlier review [1] reported that lack of awareness or knowledge, competing priorities, misunderstanding the purpose, an aversion to preventive medicine, difficulty getting an appointment with a GP, and concerns about privacy and confidentiality reduced NHS-HC attendance among the general population. A newly identified study, published in 2020, identified barriers to NHS-HC uptake amongst prisoners, which included poor accessibility to the healthcare department, stigma of visiting healthcare and fear surrounding the NHS-HC.[52]

Objective 4 *How is primary care managing people identified as being at risk of cardiovascular disease or with abnormal risk factor results?* We found variations in risk management referrals across the reviewed studies, possibly reflecting geographic variations. A newly retrieved study reported that overall fidelity of delivery of NHS-HCs in general practice was high, however, important elements of the NHS-HC, including assessments in relation to ethnicity and family history of disease, in addition to the Alcohol Use Disorders Identification Test and dementia risk management, were being regularly omitted.[53] Another new study found that practitioners often demonstrated limited understanding and confidence in explaining the 10-year risk score to patients, whereas confidence in the JBS3 lifetime CVD risk calculator, with its visual information summaries, was higher.[54]

Objective 5 *Patient views on the NHS-HC Programme:* Overall patient satisfaction levels with the programme were high, however the risk score was less helpful to patients than discussion about their health with the clinician during the NHS-HC. Although more recent research suggests that visual representations of CVD risk were more easily understood than a percentage risk score.[55] Behaviour change may be influenced by perceived risk based on family history and social support. A newly identified study reported that participants did not like the form-filling aspect of the NHS-HC.[56]

Objective 6 *What is the effect of the NHS-HC on disease detection…?*

Overall, the NHS-HC programme is associated with increased detection of CVD risk factors and diagnoses, increased prescribing of cardiovascular medications and with a general reduction in CVD risk factors. The results from two newly identified studies confirmed these findings.[49 57] The economic evidence indicated that the cost-effectiveness of the NHS-HC programme varies; population-wide interventions were more cost-effective than individual level interventions and interventions targeted at deprived areas were more cost-effective compared to non-targeted interventions. A study published in 2020 found that people with serious mental illnesses were more likely to: attend an NHS-HC; have higher rates of CKD and type 2 diabetes; and have received treatment with statins and anti-hypertensive medication, compared to people without these conditions.[50]

*Strengths and weaknesses of the study*

The methods utilised to review the evidence available on the NHS-HC Programme involved searches of published and grey literature sources, duplicate blinded screening, data extraction and quality appraisal and assessment of the quality of the overall body of evidence for each objective. Methods used to synthesise the new data with the existing body of evidence were appropriate given the quantity and types of new studies identified. Review limitations included that it was not possible to perform meta-analysis due to the heterogeneous nature of the included studies. The use of 'vote counting' methods potentially compromises the precision of the results.[58] Also, the searches undertaken for this review update were completed in December 2019, two years prior to publication of this manuscript. The evidence presented therefore, does not include more recent publications.

*Strengths and weaknesses of the available evidence*

General consistency of findings across studies in relation to each review objective supports causal inferences regarding the direction of effect of the NHS-HC Programme on the health-related outcomes assessed. The overall quality of evidence varied between objectives and ranged from 'very low' to 'moderate', reflecting issues including that most studies were observational with confounding and poor internal validity (assessed using risk of bias). Furthermore, inconsistent data collection and reporting across many of the studies reduces precision of estimated effect of the NHS-HC Programme on health-related outcomes.

*Implications for policy and practice*

The results from this review could inform changes to the methods used to invite eligible individuals to attend an NHS-HC, for example by modifying the invitation method (e.g. telephone invitations and sending text message reminders). Opportunistic recruitment could be used to selectively target specific groups who are at greater risk, as well as those who are less likely to engage with the NHS-HC Programme.

*Unanswered questions and future research*

There is a need to understand more fully the effect of the programme on lifestyle behaviours including further research to explore the impact of attending an NHS-HC on physical activity, diet, and alcohol consumption. The identified barriers to the uptake of an NHS-HC need to be explored in more depth as they could inform improvement of recruitment to the programme. In particular, future research should examine the potential of NHS-HC to widen inequalities given the demographics of participants identified in our review. A review of interventions for CVD (e.g. physical activity or diet change), outside of the NHS-HC Programme could help inform further development of the programme.

*Conclusions*:

The NHS-HC programme increases the detection of individuals at risk of cardiovascular disease. The overall body of evidence addressing the review objectives were 'very low' to 'moderate' quality therefore caution should be used when interpreting findings, which appear to show that inequalities exist in NHS-HC attendance between population sub-groups. There are also geographical variations rates of referral to lifestyle services following NHS-HC.

Targeting NHS-HC towards high-risk communities (e.g. deprived communities) may increase the cost-effectiveness of the programme. Uptake may be increased through opportunistic invitations in addition to addressing misconceptions regarding the purpose, importance and confidential nature of the programme. Discussion between NHS-HC attendees regarding their health and their GP may be more helpful than receiving a risk score, which may not be understood or remembered by the patient. Family history of disease and social support could determine the impact of the intervention on behaviour change.

**Figures** Figure 1 PRISMA Flow Chart depicting the flow of included and excluded studies.

**Contributors** FP, KT and RBG conceptualised and design the review. Literature searches were designed and implemented by Public Health England's Information Specialist Team and FP. FP, LT, RBG and RPWK reviewed titles, abstracts and full-text papers for eligibility. FP, LT, MS, RBG and RPWK completed data extraction and quality appraisal. The manuscript was prepared by FP, LT, MS and RPWK. JL, KT and RBG provided critical revision.

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**Competing interests** The research funding for this project was won by academics from Sunderland and Newcastle Universities in an open national competition from Public Health England (PHE). KT is Head of the Cardiovascular Disease Prevention Programme at PHE.

**Research Ethics Approval:** This was a review update for which secondary data from published studies were synthesised. As such, we did not collect primary data from human participants or animals for this study.

**Data sharing statement:** All data relevant to the study are included in the article or uploaded as supplementary information.

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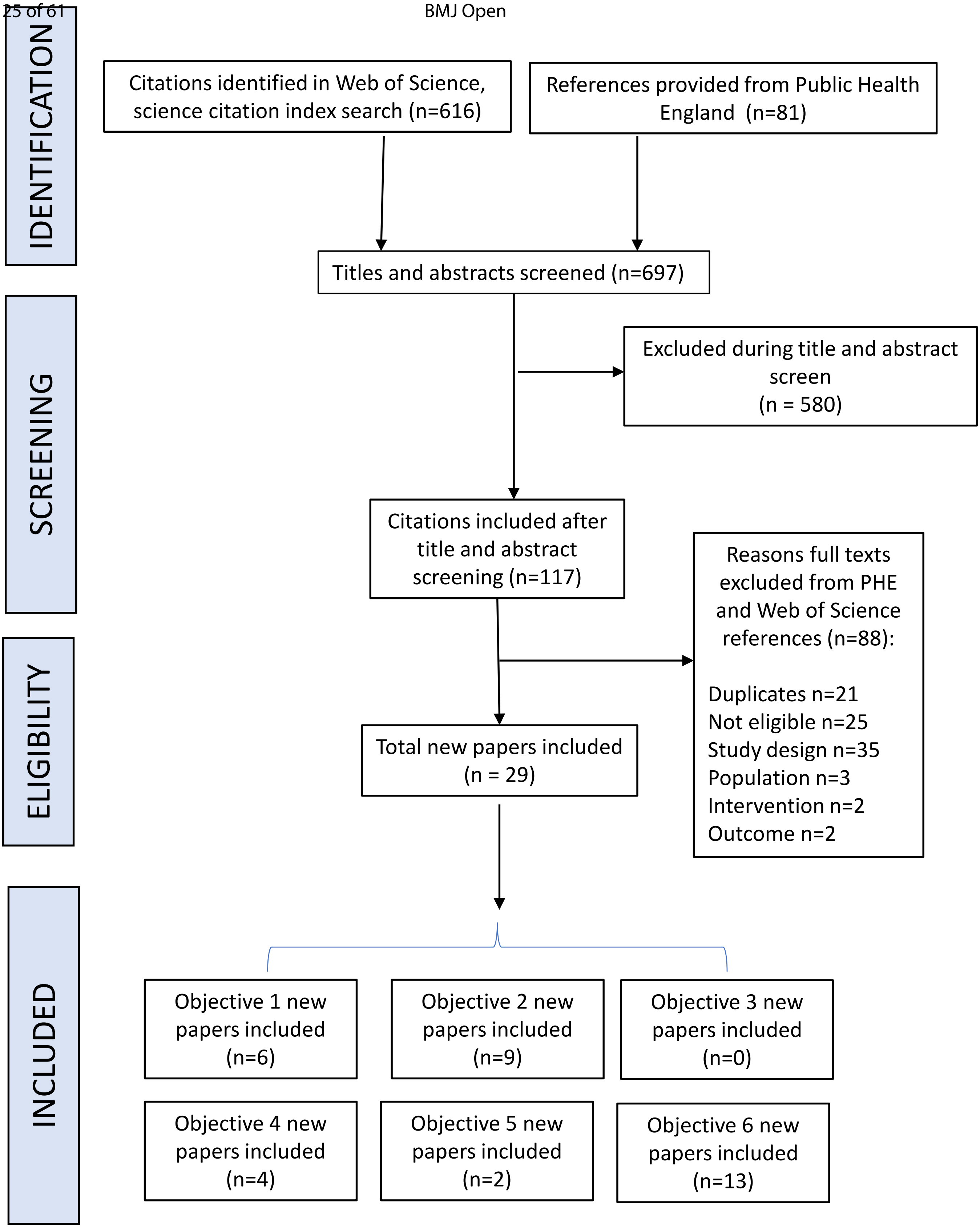


**Figure 1: PRISMA flow chart depicting the flow of included and excluded studies.**

# PRISMA 2009 Checklist

| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a systematic review, meta-analysis, or both. | 1 |
| **ABSTRACT** | | | |
| Structured summary | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | 2 |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. | 2 |
| Objectives | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | 5 |
| **METHODS** | | | |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | NA |
| Eligibility criteria | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | supplementary data S3 |
| Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | 2 and 6; supplementary data S2 |
| Search | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | supplementary data S2 |
| Study selection | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | 6/ supplementary data S3 |
| Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | 6-7 |
| Data items | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | supplementary file 6 |
| Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | 7; supplementary file 4 |

# PRISMA 2009 Checklist

| | | | |
|---|---|---|---|
| Summary measures | 13 | State the principal summary measures (e.g., risk ratio, difference in means). | NA |
| Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., $I^2$) for each meta-analysis. | 7 |



| Section/topic | # | Checklist item | Reported on page # |
|---|---|---|---|
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). | Supplementary files 4 and 5 |
| Additional analyses | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. | NA |
| **RESULTS** | | | |
| Study selection | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. | 8; Figure 1 |
| Study characteristics | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | supplementary file 6 |
| Risk of bias within studies | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12). | Supplementary file 4 |
| Results of individual studies | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. | ? |
| Synthesis of results | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency. | NA |
| Risk of bias across studies | 22 | Present results of any assessment of risk of bias across studies (see Item 15). | Supplementary file 5 |
| Additional analysis | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). | NA |
| **DISCUSSION** | | | |
| Summary of evidence | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | 2 and 15-17 |
| Limitations | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). | 17-18 |
| Conclusions | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | 18-19 |
| **FUNDING** | | | |

# PRISMA 2009 Checklist

| | | | |
|---|---|---|---|
| Funding | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. | 19 |

*From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

For more information, visit: **www.prisma-statement.org**.

| Database | Search strategy |
|---|---|
| Ovid Medline | 1. health check*.tw.<br>2. (diabetes adj3 screen*).tw.<br>3. (cardiovascular adj3 screen*).tw.<br>4. (population adj2 screen*).tw.<br>5. (risk factor adj3 screen*).tw.<br>6. (opportunistic adj3 screen*).tw.<br>7. medical check*.tw.<br>8. general check*.tw.<br>9. periodic health exam*.tw.<br>10. annual exam*.tw.<br>11. annual review*.tw.<br>12. NHSHC.tw.<br>13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12<br>14. cardiovascular adj3 prevention.tw.<br>15. (primary care or general practice or primary healthcare).tw<br>16. 14 and 15<br>17. Cardiovascular Diseases/ AND Primary Prevention/<br>18. 16 or 17<br>19. 13 or 18 |
| PubMed | 1. health check*<br>2. diabetes screen*<br>3. cardiovascular screen*<br>4. population screen*<br>5. risk factor screen*<br>6. opportunistic screen*<br>7. medical check*<br>8. general check*<br>9. periodic health exam*<br>10. annual exam*<br>11. annual review*<br>12. NHSHC<br>13. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12<br>14. Cardiovascular Diseases AND Primary Prevention[MeSH Terms]<br>15. "primary care"[Text Word] OR "general practice"[Text Word] OR "primary healthcare"[Text Word])<br>16. (cardiovascular[Text Word] AND prevention[Text Word])<br>17. #15 and #16<br>18. #14 or #17<br>19. #13 or #18 |
| Ovid Embase | 1. health check*.tw.<br>2. (diabetes adj3 screen*).tw.<br>3. (cardiovascular adj3 screen*).tw.<br>4. (population adj2 screen*).tw. |

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| | 5. (risk factor adj3 screen*).tw.<br>6. (opportunistic adj3 screen*).tw.<br>7. medical check*.tw.<br>8. general check*.tw.<br>9. periodic health exam*.tw.<br>10. annual exam*.tw.<br>11. annual review*.tw.<br>12. NHSHC.tw.<br>13. periodic medical examination/<br>14. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13<br>15. cardiovascular adj3 prevention.tw.<br>16. (primary care or general practice or primary healthcare).tw<br>17. 15 and 16<br>18. cardiovascular disease/ AND primary prevention/<br>19. 17 or 18<br>20. 14 or 19 |
| Ovid HMIC | 1 "health check*".af.<br>2 health checks/<br>3 (cardiovascular or vascular or heart or diabetes or stroke).af.<br>4 (screen* or risk).af.<br>5 3 AND 4<br>6 1 OR 2 or 5<br>7 cardiovascular adj3 prevention.tw.<br>8 (primary care or general practice or primary healthcare).tw<br>9 7 and 8<br>10 Cardiovascular diseases/ AND exp preventive medicine/<br>11 9 or 10<br>12 6 or 11 |
| EBSCO CINAHL | S10 S1 OR S2 OR S9<br>S9 S5 OR S8<br>S8 S6 AND S7<br>S7 (MH "Preventive Health Care+")<br>S6 (MH "Cardiovascular Diseases+")<br>S5 S3 AND S4<br>S4 "primary care" or "general practice" or "primary healthcare"<br>S3 TX cardiovascular N3 prevention<br>S2 (diabetes N3 screen*) OR (cardiovascular N3 screen*) OR<br>(population N2 screen*) OR (risk factor N3 screen*) OR (opportunistic<br>N3 screen*) OR “medical check*” OR “general check*” OR “periodic<br>health exam*” OR “annual exam*” OR "annual review*" OR NHSHC |

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|---|---|
| | S1 health check* |
| EBSCO Global Health | S10 S6 OR S19 OR S3 Limiters - Publication Year: 2016<br>S9 S7 AND S8<br>S8 DE "preventive medicine"<br>S7 DE "cardiovascular diseases"<br>S6 S4 AND<br>S5 S5 "primary care" or "general practice" or "primary healthcare"<br>S4 TX cardiovascular N3 prevention<br>S3 S1 OR S2 131<br>S2 (diabetes N3 screen*) OR (cardiovascular N3 screen*) OR (population N2 screen*) OR (risk factor N3 screen*) OR (opportunistic N3 screen*) OR “medical check*” OR “general check*” OR “periodic health exam*” OR “annual exam*” OR "annual review*" OR NHSHC<br>S1 health check* |
| HDAS PsycInfo | 1 "health check*".af.<br>2 PHYSICAL EXAMINATION/<br>3 HEALTH SCREENING/<br>4 "diabetes screen*".af<br>5 "cardiovascular screen*".af<br>6 "population screen*".af<br>7 ("opportunistic* screen*" OR "risk factor screen*").af<br>8 ("medical check*" OR "general check*" OR "periodic health exam*" OR "annual exam*" OR "annual review*" OR NHSHC).af<br>9 1 OR 2 OR 3 OR 4 OR 5 OR 6 OR 7 OR 8<br>10 cardiovascular.ti,ab<br>11 prevention.ti,ab<br>12 10 AND 11<br>13 CARDIOVASCULAR DISORDERS/<br>14 PREVENTIVE MEDICINE/<br>15 13 AND 14 16 12 OR 15 17 9 OR 16 |
| Web of Science, Science Citation Index | “health check*” OR “diabetes screen*” OR “cardiovascular screen*” OR “population screen*” OR “risk factor screen*” OR “Opportunistic screen*” OR “medical check*” OR “general check*” OR “periodic health exam*” OR “annual exam*” OR “annual review*” OR NHSHC OR (Cardiovascular NEAR/3 prevention) AND (“primary care” OR “general practice” OR “primary healthcare”) Limit to: England, Scotland, Wales, North Ireland |
| Cochrane Library (Wiley) | #1 "health check*" #2 (diabetes next/3 screen*) or (cardiovascular next/3 screen*) or (population next/2 screen*) or (opportunistic next/2 screen*) or ("risk factor" next/3 |

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| | screen*) or "medical check*" or "general check*" or "periodic health exam*" or "annual exam*" or "annual review*" or NHSHC #3 cardiovascular adj3 prevention.tw. #4 (primary care or general practice or primary healthcare).tw #5 #3 and #4 #6 MeSH descriptor: [Cardiovascular Diseases] this term only #7 MeSH descriptor: [Primary Prevention] explode all trees #8 #6 and #7 #9 #5 or #8 #10 #1 or #2 or #9 |
| NHS Evidence | "health check*" OR cardiovascular prevention primary care |
| TRIP database | "health check*" OR cardiovascular prevention primary care |
| Google Scholar | "nhs health check" cardiovascular "health check" cardiovascular prevention "primary care" |
| Google | "nhs health check" cardiovascular prevention "primary care" cardiovascular "health check" |
| Clinical trials.gov and ISRCDN registry | "health check" |

**PHE NHS health checks inclusion/exclusion criteria**

**Study Type Inclusion Criteria**

All studies must have included the NHS Health Check. Primary studies and guidelines will be included. Primary studies should have one of the following designs:

- RCT or cluster RCT
- Quasi RCT or cluster quasi RCT
- Controlled and uncontrolled pre- post-studies with appropriate comparator groups
- Interrupted time series
- Cohort studies (prospective and retrospective
- Case-control studies
- Qualitative studies from any discipline or theoretical tradition using recognised qualitative methods of data collection and analysis
- Economic and health outcome modelling

**Study Type Exclusion Criteria**

Editorials, commentaries and opinion pieces will be excluded

Table of inclusion and exclusion characteristics for each objective.

| Objective number | One | Two | Three | Four | Five | Six |
|---|---|---|---|---|---|---|
| **Question** | **Who is and who is not having an NHS health check** | **What factors increase take up among population and sub-groups** | **Why do people not take up an offer of an NHS health check** | **How is primary care managing people identified as being at risk of CVD or with abnormal risk factor results** | **What are patients' experiences of having an NHS health check** | **What is the effect of the NHS health check on disease detection, changing behaviours, referrals to local risk management services, reductions in individual risk factor prevalence, reducing CVD risk and on statin and antihypertensive prescribing** |
| **Research type** | Quantitative | Qualitative/Quantitative | Qualitative | Qualitative/Quantitative | Qualitative | Quantitative |
| **Included participants** | UK population eligible for NHS health checks (aged 40-74yrs) | UK population invited for NHS health checks | UK population eligible but not attending health checks | Primary care services across the UK providing health checks | UK population attending health checks | UK population eligible for NHS health checks |
| **Included measurements for extraction** | Demographics, patient condition characteristics (e.g. BMI, smoking status, CVD risk factors, etc) | Patient characteristics (subgroups, protected characteristics), setting characteristics (any health care), mode of delivery, booking system, cell/recall methods, take up rates, use of point of care testing, etc | Patient opinions, attitudes and experiences of health checks, choices made and why, reasons and beliefs underlying decisions. | Provider management protocols, recall methods, provider experiences of programme provision, referrals to lifestyle services, prescribing statins or anti-hypertensives, further investigations, adherence to guidelines etc | Patient opinions and experiences of health checks | Disease and condition detection rates, including hypertension, diabetes, chronic kidney disease, AF, familial hypercholesterolemia, peripheral vascular disease etc, behaviour change, referrals to local risk management services, reductions in individual risk factor prevalence or CVD risk, statin and anti-hypertensive prescribing, any other physical or mental health outcomes, cost effectiveness |
| **Exclusions** | Participants not eligible for health checks or receiving other forms of health check or screening services | Patients not eligible for health checks or taking up other forms of health check or screening services | Patients not eligible for health check or choosing not to take up other forms of health check or screening services | Primary care services not offering NHS health checks or people identified as at risk for CVD outside NHS health checks | Patients who have not had an NHS health check | Patients not eligible for an NHS health check |

| Objective | Author, date | Study addressed a clearly focused issue | Use of an appropriate method / Randomisation (for RCTs) | Recruitment / comparability of study groups at baseline | Blinding (for RCTs) | Exposure measurement | Outcome measurement | Comparability of study groups during study (for RCTs) | Follow up (for longitudinal studies) | Confounding factors (for non-RCTs) | Applicability to England | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 | Alageel and Wright, 2017 | High | Medium – cohort study | Medium – case and control groups were matched, but matching criteria weren't reported | NA | High | Medium – I assume that smoking prevalence was self-reported | NA | High | Medium/ can't tell | High | Medium |
| 6 | Chang et al. 2017 | High | Low - survey | Medium – lack of information re characteristics of comparison groups (e.g. the male sample could have been older and more prone to each health condition compared to the female group) | NA | High | Medium – lack of information re diagnosis of each condition of interest | NA | NA – this was a survey | Medium / can't tell – see 'recruitment/ comparability of study groups'<br><br>As gender and level of deprivation groups and were compared, these factors were controlled, however there was lack of control for multiple confounding | High | Low |

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| | | | | | | | | | | factors in each analysis | | |
| 2 | Coghill et al. 2016 | High | Medium – quasi experimental study | Medium – characteristics of comparison groups are presented, however there are no statistical comparisons to assess if the groups differ significantly on any characteristics | NA | High- standard approaches appear to have been used, with training provided to community workers who provided the telephone invites | High – attendance versus non-attendance and demographic characteristics, which I assume were accurately measured | NA | NA | Medium – age, gender, IMD but smoking and ethnicity were not controlled for | Low -data from Bristol | Low |
| 6 | Coghill et al. 2018 | High | Low- cross sectional | NA | NA | High- I would have thought it unlikely that demographic data were inaccurate | High - attendance or non-attendance at NHS Health Check | NA | NA – this was a survey | Medium – age, gender and IMD, but not ethnicity controlled for in adjusted models | Low – data from 38 GP practices, in Bristol. | Medium |
| 6 | Collins 2019 | Medium - not explicit | High | NA | NA | High | High | NA | NA | NA | Low – data from Liverpool | High |
| 6 | Collins 2017 | Medium - not explicit | High | NA | NA | High | High | NA | NA | NA | Low – data from Liverpool | High |
| 2 | Cornelius 2018 | Medium | High - RCT | Medium | Low – as unable to blind the format of the letter from participants | High – appears to have been standardised within groups | High (NHS health check uptake) | Medium (see 'Recruitment / comparability of study groups at baseline') | NA | NA | Low- data from 12 GP practices | Low |

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| 2 | Gidlow 2019 | High | High – RCT | Medium - | Low – as unable to blind the format of the letter from participants | High | High | Medium (see 'Recruitment / comparability of study groups at baseline') | NA | NA | Low- practices from Stoke-on-Trent and Staffordshire | Low |
| 2 & 6 | Gulliford 2017 | High | Medium– cohort study | Medium | NA | High | High | NA | NA | High – ORs were adjusted for gender, age-group, ethnicity and IMD quintile | Low – study was conducted using data from two London boroughs | Medium |
| 6 | Hinde 2017 | High | High | NA | NA | High | High | NA | NA | NA | High | High |
| 1 | Chattopadhyay 2019 | High | Low- survey | NA | NA | High | High | NA | NA – this was a survey study | High- Multiple confounders were adjusted for in the multiple logistic regression models | Low-data from Leicester dataset | Medium |
| 6 | Kennedy 2019 | High | Medium- quasi RCT | Medium- variation in relation to age of attendees versus non-attendees, with attendees being older and therefore more likely to have the medical | NA | High | High | NA | NA | Medium as age and gender were controlled for in the analyses | Low – data from south England | Low |

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| | | | | conditions of interest | | | | | | | | |
| 2 | McDermott 2018 | Medium | High - RCT | High – age, ethnicity, gender and IMD appeared to be well balanced across groups | High | High | High | High | NA | NA | Low – 18 GP practices in two London boroughs | High |
| 6 | Mytton 2018 | High | High | NA | NA | High | High | NA | NA | NA | High | High |
| 6 | Palladino 2017 | High | Medium – quasi experimental study | Low -can't tell/ not reported | NA | High | High | NA | NA | Low – can't tell | High | Medium |
| 2 | Public Health England 2018 | High | High- RCT | Medium – age and sex were comparable across groups; lack of data were presented re the proportion of additional traits (e.g. ethnicity and deprivation level) across study groups | High | High | High | Medium | NA | NA | Low- practices from Lewisham and Lincolnshire | Medium |
| 6 | Robson 2017 | High | Medium – observational matched study | Medium – females were more likely than males to attend; there was also variation in attendance | NA | High | High | NA | NA | Medium – as females were more likely to attend, thus potentially reducing the perceived | Low – East London GP practices | Low |

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| | | | | according to ethnicity, however deprivation and age variations were approximately balanced between groups | | | | | | effectiveness of the programme for disease detection as males are more likely to have higher risk of CVD | | |
| 2 | Sallis 2019 | High | High - RCT | Medium- significant differences were found in relation to ethnicity in the SMS pre-notification comparison groups, and WRT sex between groups who received different letter types. Lack of significant difference re other key confounders. | High | High | High | Medium | NA | NA | Low – data from one London borough | Medium |
| 1 | Woringer 2017 | Medium | Low- cross sectional | Medium- No significant differences were found in relation to ethnicity between groups, | NA | High | High | Medium | NA | Medium | High | Low |

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| | | High | | however there were sig difference in age, sex and deprivation level between attendees and the general population | | | | | | | | |
| 4 and 6 | Alageel & Gulliford (2019) | High | Medium | High | NA | High | High | NA | High | Medium | High | High |
| 6 | Chang et al. (2016b) | High | High | High | NA | Medium | High | NA | Medium | High | High | Medium |
| 2 | Gold et al. (2019) | High | Medium | Medium | High | High | High | Medium | NA | NA | Low | High |
| 1 and 6 | Lang et al. (2016) | High | Low | HNA | NA | Medium | High | NA | NA | Medium | Medium | Medium |
| 2 | Whittaker (2019) | High | Low | Low | NA | Medium | Medium | NA | NA | Low | Low | Low |

**Table 1. Objective 1: Are there differences in demographic factors of those attending and not attending an NHS Health Check?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 29 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | none | ⨁⨁◯◯ LOW | IMPORTANT |

a. One study had a quasi-experimental design, the others were observational studies of various designs.

b. A significant proportion of the studies were rated low for baseline imbalances between groups and lack of control for confounding, however the purpose of this question was to assess variations in NHS Health Check attendance versus non-attendance between population sub-groups in relation to social characteristics, therefore imbalances in characteristics between the intervention and control groups were expected and these are likely to reflect reality.

c. Overall the results indicate that older persons and females were most likely to attend an NHS Health check. The results were less consistent in relation to ethnicity. Results tended to vary according to the sample size and geographic coverage of each study. Studies also varied in relation to setting and the cardiovascular risk profile of participants, therefore inconsistencies were not unexplained.

d. The overall sample size is large.

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**Table 2. Objective 2.1: Do socio-demographic factors affect update of the NHS Health Check?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 12 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | none | ⨁⨁◯◯ LOW | IMPORTANT |

a. One study was a randomized controlled trial, one study had a quasi-randomized design; the remaining studies were non-randomized studies, mainly experimental.

b. Six (50%) of the studies received a 'low' rating for domains relevant to the risk of bias, however four of these the issues were in relation to baseline imbalances and confounding, however the purpose of this research objective is to identify sociodemographic differences between attendees and non-attendees. Only two of twelve studies received a low rating for domains relevant to the risk of bias (exposure and outcome measurement and blinding). However, in the context of the NHS Health Checks programme, where the intervention is obvious and data are routinely collected and subject to inaccuracies, these issues don't necessarily indicate poor quality research methods were used.

c. Generally, older persons, females and individuals from least deprived background were most likely to attend NHS Health Checks. The results in relation to ethnic group were mixed. Variations in results across studies are likely to reflect heterogeneity between studies, including different methods and geographical coverage.

d. The sample size overall, across the included studies was large.

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**Table 3. Objective 2.2: Do variations to the invitation method affect NHS Health Check attendance? Assessment of quantitative evidence**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 13 | observational studies[a] | serious[b] | not serious[c] | not serious | not serious[d] | None | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. 6 RCTs; N=2 quasi-randomized trials; the remaining studies used observational designs.

b. Most (>50%) of studies scored low for one or more domain that could introduce bias into the study results.

c. The standard national invitation letter was generally associated with reduced uptake compared to variations. The variations differed between studies, therefore differences in relative uptake between groups in each study are expected.

d. The sample size was large (in the thousands) across studies.

**References:**


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2. Kumar J, Chambers R, Mawby Y, et al. Delivering more with less? Making the NHS Health Check work in financially hard times: real time learning from Stoke-on-Trent. *Qual Prim Care* 2011;19(3):193-9.
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10. McDermott L, Wright A, Cornelius V. Enhanced invitation methods and uptake of health checks in primary care. Rapid randomised controlled trial using electronic health records. *Health Technology Assessment* 2017;20(84)
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13. Gidlow CJ, Ellis NJ, Riley V, et al. Randomised controlled trial comparing uptake of NHS Health Check in response to standard letters, risk-personalised letters and telephone invitations. *BMC Public Health* 2019;19(1):224.

**Table 4. Objective 2.2 Do variations to the invitation method affect NHS Health Check attendance? Assessment of qualitative evidence**

| **Finding** | **Studies contributing to findings (see report reference list)** | **Methodological limitations** | **Coherence** | **Adequacy** | **Relevance** | **CERQual assessment of confidence in the evidence** | **Explanation of CERQUAL assessment** |
|---|---|---|---|---|---|---|---|
| Differing views on opportunistic recruitment depending on setting | Greenwich *et al* (2011)<br>Ismail *et al* (2015)<br>Perry *et al* (2014)<br>Riley *et al* (2015) | Most papers were highly rated in terms of quality, with only one being rated overall as medium quality. Two papers scored low in ethical issue and one in rigour | There were no or few concerns identified in any of the papers as they all presented similar data to the findings presented in the review. | Three papers had minor concerns due to not presenting a rich picture of the data gathered. The other had no or few minor concerns | One of the papers had moderate concerns as the quote presented in the review was not clearly linked to the theme and the paper did not otherwise refer to this theme.[51] | Moderate confidence | Reduced grade due to moderate concern and minor concerns around ethical issues and richness of data |
| Benefit of community ambassadors, particularly for ethnic minority groups | Riley *et al* (2015)<br>Stone *et al* (2019) | One paper was medium and one high rated, both scored lower in their description of the relationship between researcher and participants. | There were no or few concerns identified in either paper in this domain. | No or few minor concerns | No or few minor concerns in either paper | High confidence | No reason to downgrade |
| Preference for telephone contact | Stone *et al* (2019)<br>Strutt *et al* (2011)<br>Greenwich *et al* (2011) | Greenwich and Stone medium quality overall, Strutt high quality overall | No coherence concerns | Moderate concern due to richness of data gathered | No concerns | Moderate confidence | Reduced grade due to concerns on richness of data |

**Table 5. Objective 2.3 Does GP practice versus alternative setting affect NHS Health Check uptake?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 2 | observational studies | serious [a] | not serious [b] | not serious | not serious [c] | none | ⊕◯◯◯ VERY LOW | IMPORTANT |

a. Both studies scored low for imbalances in baseline characteristics between groups and confounding.

b. One study reported higher uptake in GP surgeries whereas the other reported similar attendance between settings. This variation is likely to reflect heterogeneity between studies in relation to the population, mode of invitation and the type of non-GP setting in which the NHS Health Checks were performed.

c. Overall sample size across the two studies was large (in the thousands)

**References:**


1. Roberts DJ, de Souza VC. A venue-based analysis of the reach of a targeted outreach service to deliver opportunistic community NHS Health Checks to 'hard-to-reach' groups. *Public Health* 2016;137:176-81.
2. Whittaker PJ. Uptake of cardiovascular health checks in community pharmacy versus general practice. *Journal of Fluid Mechanics* 2020;884:6.

**Table 6. Objective 4 Support for the concept of management of people identified as being at risk of CVD, as an outcome of the NHS Health Checks intervention Assessment of mixed methods evidence.**

| Domain | Assessment of support | Level of support |
|---|---|---|
| Truth value/bias | Inferences and conclusions were reflected in the quantitative and qualitative data. | Moderate |
| Explanation credibility | The issues raised by health professionals were sound. There was a lack of exploration of the reasons why service delivery/ implementation/ follow up, between practices. | Moderate |
| Weakness minimisation | Data in relation to this concept were collected from quantitative, qualitative and mixed methods although the study designs were homogeneous (quant data collected from cross-sectional surveys; qualitative data collected from free text responses and semi-structured interviews). Consistencies were apparent across different study types in relation to variations in service delivery, referrals and follow ups. | Strong |
| Inside-outside | Quantitative and qualitative data were collected, however interview and survey methods may entail responder and reporting biases. Objectivity of these methods is therefore limited. | Low |
| Publication bias | Lack of significance testing therefore it is not possible to assess for this criterion | n/a |
| Additional comments | None | n/a |
| Overall assessment | Moderate | |

**References:**


1. Baker C, Loughren EA, Crone D, et al. A process evaluation of the NHS Health Check care pathway in a primary care setting. Journal of public health (Oxford, England) 2015;37(2):202-9.
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5. Riley R, Coghill N, Montgomery A, et al. The provision of NHS health checks in a community setting: an ethnographic account. BMC health services research 2015;15:546. doi: 10.1186/s12913-015-1209-1
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7. Alageel S, Gulliford MC, McDermott L, et al. Implementing multiple health behaviour change interventions for cardiovascular risk reduction in primary care: a qualitative study. BMC Fam Pract 2018;19(1):171.
8. Alageel S, Gulliford MC, Wright A, et al. Engagement with advice to reduce cardiovascular risk following a health check programme: A qualitative study. Health Expect 2020;23(1):193-201.
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14. Riley R, Coghill N, Montgomery A, et al. Experiences of patients and healthcare professionals of NHS cardiovascular health checks: a qualitative study. Journal of public health (Oxford, England) 2016;38(3):543-51.
15. Shaw RL, Pattison HM, Holland C. Be SMART: examining the experience of implementing the NHS Health Check in UK primary care. BMC Fam Pract 2015;16:1.
16. Shaw RL, Lowe H, Holland C, et al. GPs' perspectives on managing the NHS Health Check in primary care: a qualitative evaluation of implementation in one area of England. BMJ Open 2016;6(7):e010951.
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18. Crabtree V, Hall J, Gandecha M. NHS Health Checks: The views of community pharmacists and support staff. Int J Pharm Pract 2010 2010;18:35-6.
19. Graley CEM, May KF, DC. M. Postcode lotteries in public health - the NHS Health Checks Programme in North West London. BMC Public Health 2011;11:738.
20. Krska J, du Plessis R, Chellaswamy H. Views of practice managers and general practitioners on implementing NHS Health Checks. Prim Health Care Res Dev 2016;17(2):198-205.
21. Loo RL, Diaper C, Salami OT. The NHS Health Check: The views of community pharmacists. Int J Pharm Pract 2011;19:13.

**Table 7. Objective 5 Support for the concept of patient experiences as an outcome of the NHS Health Checks intervention Assessment of mixed methods evidence.**

| Domain | Assessment of support | Level of support |
|---|---|---|
| **Truth value/bias** | Inferences and conclusions made by authors were reflected in the quantitative and qualitative data reported. For example, high levels of satisfaction were evident in the results from quantitative survey data, and participant quotes supported the themes derived by authors.<br>The quantitative data presented from satisfaction surveys were based on questions that were perhaps too broad in focusing on general, overall satisfaction. However, the negative aspects of patients' experiences were captured in the qualitative data.<br>It would have been helpful if the studies which used mixed methods had collected numeric data based on the results from the qualitative methods. For example, by quantifying the number/ proportion of patients who issues expressed through the qualitative data (e.g. how many understood their risk score) | Moderate |
| **Explanation credibility** | The issues regarding patient experiences of the NHS Health Checks programme that were reflected in quotes are understandable (e.g. patient expectations that a 'Health Check' would entail testing for medical conditions not just affecting the cardiovascular system; lack understanding of the risk score). Some studies lacked exploration of the social and psychological mechanisms relating to the issues that patients experienced. For example, the reasons why many attendees would struggle to interpret the risk score. | Moderate |
| **Weakness minimisation** | Supported across limited quantitative (cross-sectional surveys) and several qualitative designs (free-text survey responses; focus groups and interviews). The quantitative data indicate a high level of patient satisfaction, whereas the data from qualitative studies highlight issues with the NHS Health Checks Programme | Inconsistent support |
| **Inside-outside** | The data covers views and quantitative responses from patients. These methods are all at risk of responder bias and may represent the views of those with particularly strong opinions. Objectivity of these methods is therefore limited. | Low |
| **Publication bias** | Lack of significance testing therefore it is not possible to assess for this criterion | n/a |

| | | |
|---|---|---|
| **Additional comments** | None | n/a |
| **Overall assessment** | Low/moderate | |



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3. Trivedy C, Vlaev I, Seymour R, et al. An evaluation of opportunistic health checks at cricket matches: the Boundaries for Life initiative. Sport in Society 2017;20(2):226-34.
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16. Research Works. Public Health England Understanding the implementation of NHS Health Checks. 2013
17. Riley R, Coghill N, Montgomery A, et al. Experiences of patients and healthcare professionals of NHS cardiovascular health checks: a qualitative study. Journal of public health (Oxford, England) 2016;38(3):543-51.

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24. Shaw RL, Pattison HM, Holland C, et al. Be SMART: examining the experience of implementing the NHS Health Check in UK primary care. BMC Fam Pract 2015;16:1.

**Table 8 Objective 6.1** Are disease detection rates higher for GP practices in areas with high versus low population coverage of the NHS Health Check programme?

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 3 | observational studies[a] | not serious | not serious[b] | serious[c] | not serious[d] | none | ⨁◯◯◯ VERY LOW | CRITICAL |

a. Study descriptions were: quasi-experimental study; non-randomised controlled study and an observational study

b. Palladino (2017) found that high NHS Health Checks program coverage was associated with increased detection of diabetes whereas Lambert (2015) found that increased population coverage of the NHS Health Checks programme was not associated with growth in GP practice disease registers for diabetes. Caley (2014) found no significant associations between % eligible completing an NHS Health Check and change in prevalence of five conditions including diabetes. These variations could reflect ecological effects, attributable to differences in the geographical coverage of each study.

c. The nature of the intervention group varied between studies. For example, Palladino (2017) compared GP practices with high versus medium or low coverage; Lambert (2016) assessed variation in detection rates in relation to number of health checks performed across practices (therefore no binary intervention and control groups) and Calley (2014) compared practices that offered the intervention with control practices which did not.

d. One of the studies (Palladino 2017) used data from a large sample and the confidence intervals did not cross the line of no effect.

**References**

1. Palladino R, Vamos E, Chang KCM, et al. Impact of a national diabetes risk assessment and screening programme in England: a quasi-experimental study. Lancet 2017;390:S65-S65.
2. Caley M, Chohan P, Hooper J, et al. The impact of NHS Health Checks on the prevalence of disease in general practices: a controlled study. *Br J Gen Pract* 2014;64(625):e516-21.
3. Lambert MF. Assessing potential local routine monitoring indicators of reach for the NHS health checks programme. *Public Health* 2016;131:92-8.

**Table 9 Objective 6.1 Are disease detection rates higher amongst those attending an NHS Health Check following an opportunistic versus standard invitation?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 1 | observational studies | not serious[a] | [b] | not serious | serious[c] | none | - | CRITICAL |

a. The study received one low overall rating, however this was in relation to the external rather than internal validity of the study.
b. Not applicable as only one study is included in this GRADE assessment.
c. The sample size was relatively small and the confidence intervals quite wide for >10% CVD risk in this study.

## References

Gulliford MC, Khoshaba B, McDermott L, et al. Cardiovascular risk at health checks performed opportunistically or following an invitation letter. Cohort study. Journal of public health (Oxford, England) 2018;40(2):e151-e56.

**Table 10 Objective 6.1 Are disease detection rates higher amongst those attending an NHS Health Check versus those who do not attend?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 4 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | strong association[e] | ⨁⨁⨁◯ MODERATE | CRITICAL[f] |

a. One study had a quasi-experimental design, three were cohort studies.
b. None of the studies received low ratings for domains relevant to internal validity/ risk of bias.
c. Overall, the intervention was associated with increased disease detection. Rates for individual diagnoses varied across studies however this is likely to reflect differences between samples, as some studies used national data whereas others used data from regions or smaller spatial units.
d. Some of the studies were small and potentially under powered, however several studies used national data sets and therefore the overall sample size is large. Confidence intervals crossed the line of no effect in some cases however generally, confidence intervals were not large.
e. Robson (2017) reported the rate of chronic kidney disease diagnosis amongst attendees as 83%.
f. The purpose of the NHS Health Checks program is to screen for chronic health conditions.

## References

1. Kennedy O, Su F, Pears R, Walmsley E, Roderick P. Evaluating the effectiveness of the NHS Health Check programme in South England: a quasi-randomised controlled trial. BMJ Open. 2019 Sep 20;9(9):e029420.
2. Robson J, Dostal I, Madurasinghe V, Sheikh A, Hull S, Boomla K, et al. NHS Health Check comorbidity and management: an observational matched study in primary care. Br J Gen Pract. 2017 Feb;67(655):e86-e93.
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4. Forster AS, Dodhia H, Booth H, et al. Estimating the yield of NHS Health Checks in England: A population-based cohort study. J Public Heal (United Kingdom) 2015;37:234–40.

**Table 11 Objective 6.2 Does NHS Health Check attendance versus non-attendance influence health-related behaviour (smoking status/ prevalence)?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 5 | observational studies[a] | serious[b] | serious[c] | not serious | Not estimable[d] | none | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. One randomised study and four observational studies.

b. Mode of collection of smoking data wasn't consistently reported, however it is likely to have been self-report and entered into routine medical records which relies on patients both attending the general practice and being asked about their smoking status within that time. Issues associated with self-report data and completeness could introduce biases in relation to the outcome measurement.

c. Although point estimates indicated a reduction in smoking across studies, there were inconsistencies regarding the statistical significance of these effects between studies.

d. Imprecision is not estimable due to differences in effect calculations between studies.

## References

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2. Forster AS, Dodhia H, Booth H, et al. Estimating the yield of NHS Health Checks in England: a population-based cohort study. *Journal of public health (Oxford, England)* 2015;37(2):234-40.
3. Alageel S, Gulliford MC. Health checks and cardiovascular risk factor values over six years' follow-up: Matched cohort study using electronic health records in England. *PLoS Med* 2019;16(7):e1002863.
4. Cochrane T, Davey R, Iqbal Z, et al. NHS health checks through general practice: randomised trial of population cardiovascular risk reduction. *BMC Public Health* 2012;12(1):944.
5. Artac M, Dalton AR, Majeed A, Car J, Huckvale K, Millett C. Uptake of the NHS Health Check programme in an urban setting. Family practice. 2013 Aug 1;30(4):426-35.

**Table 12 Objective 6.3 What proportions of NHS Health check attendees receive risk management advice or referrals?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 11 | observational studies[a] | serious [b] | serious[c] | not serious | not serious[d] | none | ⨁◯◯◯ VERY LOW | IMPORTANT |

a. One quasi-randomised controlled trial(Kennedy *et al* 2019)[97]; the remaining studies had an observational design.

b. Two studies (Krska *et al* 2015[23] and Baker *et al* 2015[17]) were rated low on confounding; one study (Foster 2015[13]) was rated low on outcome measurement. These are issues relevant to the internal validity of a study.

c. Large variations existed in the proportions of patients being referred to lifestyle services between studies. This heterogeneity is likely reflective of geographical variations in referrals.

d. The eleven studies which reported relevant data to address the research question were mixed in their coverage; some used national datasets with large sample sizes other studies used regional data. Overall however, the sample size was large. Confidence intervals were not presented for several studies and it is likely that the confidence intervals were large for the regional studies, however in several of the larger studies for which CIs were presented, these were narrow.

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## References


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2. Robson J, Dostal I, Sheikh A, et al. The NHS Health Check in England: an evaluation of the first 4 years. BMJ Open 2016;6(1):e008840.
3. Cochrane T, Gidlow CJ, Kumar J, et al. Cross-sectional review of the response and treatment uptake from the NHS Health Checks programme in Stoke on Trent. J Public Heal (United Kingdom) 2013;35:92–8.
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6. Baker C, Loughren EA, Crone D, et al. Perceptions of health professionals involved in a NHS Health Check care pathway. Pract Nurs 2015;26:608–12.
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10. Coghill N. Improving the uptake of NHS Health Checks in more deprived communities using ' outreach ' telephone calls made by specialist health advocates from the same communities : A quantitative service evaluation. 2016.

11. Kennedy O, Su F, Pears R, Walmsley E, Roderick P. Evaluating the effectiveness of the NHS Health Check programme in South England: a quasi-randomised controlled trial. BMJ Open. 2019 Sep 20;9(9):e029420.

**Table 13 Objective 6.4 Does the NHS Health Check versus no NHS Health Check reduce cardiovascular disease risk?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 5[a] | observational studies[b] | serious[c] | not serious[d] | not serious | not serious[e] | none | ⨁◯◯◯ VERY LOW | CRITICAL |

a. One study was a randomized trial, the other four were observational studies.
b. One study had a domain with a low rating - Forster (2015), for outcome measurement. This could affect the internal validity for assessment of the association between NHS Health Checks and CVD risk. Although the other four studies studies were rated as medium or high for this domain, the study by Forster (2015) was the largest study in the analysis and could have impacted significantly on the overall results.
c. Results were generally consistent across studies
d. Decision based on confidence intervals which were reasonably narrow and did not cross the line of no effect. Also, only one of the studies did not use a national data set with a large sample size.
e. Decision based on confidence intervals which were reasonably narrow and die not cross the line of no effect. Also, three of the studies used national data sets with a large sample size.

**References**


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**Table 14. Objective 6.5 Does the NHS Health Check versus no NHS Health Check increase prescribing of statins or antihypertensive medication?**

| № of studies | Study design | Risk of bias | Inconsistency | Indirectness | Imprecision | Other considerations | Certainty | Importance |
|---|---|---|---|---|---|---|---|---|
| 16 | observational studies[a] | not serious[b] | not serious[c] | not serious | not serious[d] | none | ⨁⨁◯◯ LOW | IMPORTANT |

a. One study was a randomised trial, the remaining 15 had an observational design

b. The only study that received a low rating for a domain relevant to risk of bias was Krska 2016 which scored low for confounding. As other studies scored medium or high on this domain, it was deemed that risk of bias overall wouldn't be significantly affected.

c. Most studies show an increase in prescribing following the NHS Health Check. The exception is Alageel 2019 in relation to prescribing of anti-hypertensive medication.

d. Although variations in effect estimates are present between studies, this heterogeneity may be attributable to factors including different sample sizes and differences in study designs. The confidence intervals reported appear reasonably small and do not cross the line of no effect.

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1. Alageel S, Gulliford MC. Health checks and cardiovascular risk factor values over six years' follow-up: Matched cohort study using electronic health records in England. PLoS Med 2019;16(7):e1002863.
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4. Forster AS, Burgess C, Dodhia H, et al. Do health checks improve risk factor detection in primary care? Matched cohort study using electronic health records. Journal of Public Health 2015;38(3):552-59.
5. Jamet G, Tubeuf S, Meads D. Leeds Institute of Health Sciences Has the introduction of NHS health checks increased the prescription of statins for CVD prevention? 2014.
6. Robson J, Dostal I, Madurasinghe V, et al. NHS Health Check comorbidity and management : an observational matched study in primary care. Br J Gen Pract Published Online First: 2016.
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8. Chang KC-M, Soljak M, Lee JT, et al. Coverage of a national cardiovascular risk assessment and management programme (NHS Health Check): Retrospective database study. Prev Med (Baltim) 2015;78:1–8.

9. Dalton AR, Bottle A, Okoro C, et al. Uptake of the NHS Health Checks programme in a deprived, culturally diverse setting: cross-sectional study. Journal of public health (Oxford, England) 2011;33(3):422-9.
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